SCIENTIFIC AMERICAN

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Vol. XCI.—No. 27. ESTABLISHED 1845.] NEW YORK, DECEMBER 31, 1904. [8 CENTS A COPY $3.00 A YEAR.

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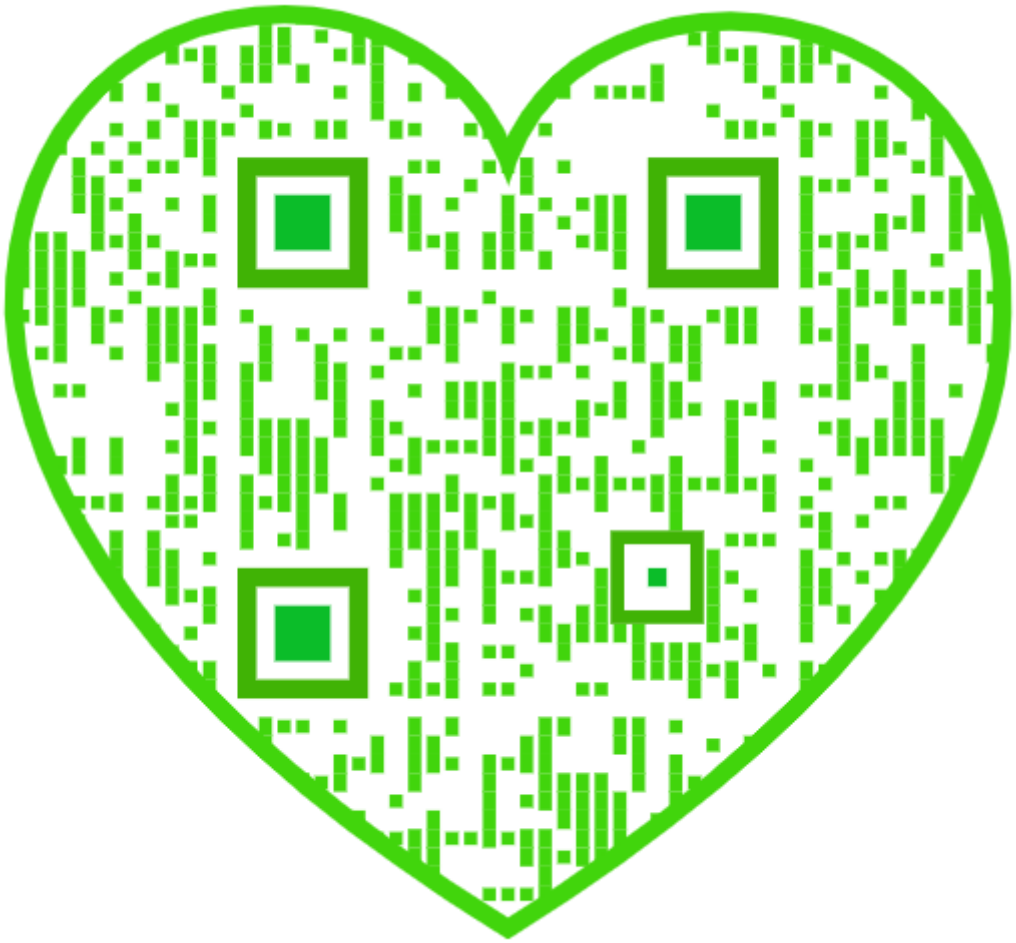
THE LEBAUDY AIRSHIP, "LE JAUNE," ASCENDING FROM THE MEADOWS OF MOISSON, FRANCE.—[See page 478.]



SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

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Scientific American (Established 1845) ..... $3.00 a year
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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, DECEMBER 31, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE LONGEST SPAN BRIDGE IN THE WORLD.

There is now under construction across the St. Laurence at Quebec a cantilever bridge which when completed will contain the longest span of any bridge yet erected, not even excluding the great cantilevers of the Forth Bridge in Scotland. The structure is of the cantilever type, and consists of two approach spans, of 210 feet each, two shore arms, each 500 feet in length, and a great central span, 1,800 feet in length. The total length of the bridge is 4,220 feet, and although in extreme dimensions it does not compare with the Firth of Forth Bridge, which is about one mile in total length, it has the distinction of having the longest span in the world by 90 feet, the two cantilevers of the Forth Bridge being each 1,710 feet in length. The total width of the floor is 80 feet, and provision is made for a double-track railway, two roadways for vehicles, and two sidewalks. In a cantilever of this magnitude the individual members are necessarily of huge proportions, the main posts, for instance, being 325 feet in length, and each weighing 750 tons.

RECORD RUN OF A STEAM TURBINE.

On the morning following the close of the St. Louis Exposition, great interest attached to the shutdown and inspection of the 600-horse-power steam turbine generating unit in the Palace of Machinery after a continuous run of over 3,962 hours—a performance which has had no parallel in steam turbine history. This machine, which is of the Westinghouse-Parsons type, was started on its long run on the morning of Monday, June 20, shortly after its instaliation at the Fair, and was stopped on the morning of Friday, December 2. During the five and a half months that the unit was in operation, it supplied current for light and power in various buildings of the Exposition. Several engineers connected with the builders of the turbine and with the Machinery Department of the World's Fair were present when the engine was stopped and examined. It was found to be in perfect condition, as shown by the fact that there were no signs of wear, and that the bearings still retained the tool marks which they carried when they came from the shops. The remarkable feature of this performance, of course, was the maintenance under load of a speed of 3,600 revolutions per minute for such a long period. Every day from half past eight o'clock in the morning to half past ten in the evening during this continuous run, the load carried varied from 25 per cent underload to 25 per cent overload. The total number of revolutions was but little below one billion.

A SEA-LEVEL CANAL AT PANAMA.

The investigations of the United States engineers along the route of the Panama Canal and in the watershed of the Chagres River have raised the question as to whether it would not be more to the ultimate advantage of the United States, and of sea-going commerce in general, to build the canal on a broader scale to meet the rapidly growing dimensions of steamships, and also whether it would not be wiser to build it with a lower summit level, or abolish the lockage system altogether, and cut the canal through at one level from ocean to ocean. Mr. Wallace, Chief Engineer of the Isthmian Canal Commission, has recently given testimony before the House Committee on Interstate and Foreign Commerce, in which he discussed the relative advantage of four distinct plans for building the canal. Incidentally, it was shown by his testimony that the engineering difficulties at the site of the Bohio dam would be greater than was formerly estimated, the more elaborate borings that are now being made having shown that the rock bottom is much lower than was supposed, the later borings having been carried down to an average depth of 163 feet without reaching bedrock.

The first plan is the one favored by the former Canal Commission, which calls for a dam at Bohio and a high-level canal with an elevation of 90 feet above sea level.

The second plan calls for a 60-foot summit level, with a dam 60 feet high at Bohio, or else the construction of a dam of the same height at Gatun, about half way from Bohio to Colon, the Atlantic terminus of the canal. The adoption of a 60-foot level will involve constructing a dam at Gamboa to furnish water for the summit level. The Gamboa dam would control the Chagres River; but it would necessitate the provision of a spillway in the shape of a tunnel eight miles in length through the divide, to discharge the surplus water of the Chagres into the Pacific, or a tunnel four miles long to carry these waters to the Atlantic. The four-mile tunnel would involve the construction of an auxiliary channel for the Chagres from Gatun to the sea, in order to carry its flood waters away in safety.

The third alternative plan contemplates a 30-foot summit level, with a single lock at Miraflores, near the Pacific, and a single lock at Bohio. This plan would also involve the construction of the Gamboa dam above referred to.

The fourth plan contemplates the construction of a sea-level canal with a tidal lock at Miraflores, this lock being necessitated by the fact that there is an extreme range in the tide of twenty feet on the Pacific side, whereas the fluctuation is less than two feet on the Atlantic side. If no locks were built on the Pacific end, the variations in tide levels would produce strong currents in the canal, which would render navigation difficult.

The 90-foot level canal would cost $200,000,000 and take about ten years to complete; the 60-foot level canal would cost $225,000,000, and it could be opened for traffic in ten years and completed in twelve years; the 30-foot level canal, which would cost $250,000,000, could be opened for traffic in twelve years and completed in fifteen years; while the sea-level canal would cost $300,000,000, could be opened for traffic in fifteen years, but would take twenty years to complete. In all these estimates the controlling factor, both as to cost and time of completion, is the great cut through the mountain divide at Culebra, the amount of material that would have to be removed increasing rapidly with every foot that the summit level of the canal is lowered.

The determination as to which of these alternative schemes should be adopted, will call for most mature consideration. The problem must be looked at from the broadest possible standpoint, and it must be treated in a duly international spirit, and with a strict eye to the future. Ships are now building that call for a full-load draft of between 36 and 37 feet, and two of these vessels are to have an extreme breadth of 87 feet 6 inches. The two most important questions relating to the canal, if due consideration is given to the inevitable growth in the size of steamships and in the volume of traffic, are its section, that is to say, its width and breadth, and its summit elevation. Of the two, the canal section is the more important, and if the finances of the country will admit, the canal should be cut on dimensions sufficient, not merely for existing deep-sea vessels, but for the larger vessels of the future. The question of summit level, as far as it affects future operation of the canal, is not of such vital importance, since the difference between a canal with locks and one without is mainly a question of the time occupied in transit.

It is certain that the raising by the chief engineer of the question of alternative plans, among which a sea-level canal is given prominence, will result in an agitation for the construction of a great sea-level waterway, which, by the way, was the original de Lesseps idea. There is much to recommend the larger plan. It gets rid of the Bohio dam problem, now of stupendous proportions; it abolishes the summit locks and the necessity for providing a supply of water to feed the canal; and it simplifies both maintenance and operation. But what of the cost and the delay!

TECHNICAL DESCRIPTION OF THE "CZAREVITCH" IN ACTION.

In the current issue of the SUPPLEMENT will be found the first reliable and expert description of the sortie of the Russian fleet on August 10, and the damage received by the flagship "Czarevitch" from the concentrated fire of the Japanese fleet. The article, which is a translation from the leading German naval journal, Marine Rundschau, is marked by that detailed and careful observation which characterizes German literature of this kind, and it is accompanied by over a dozen illustrations showing by photograph and diagram the tactics employed by the combatants and the nature of the damage done on the "Czarevitch." This vessel, being the flagship and at the head of the line, was made the target for the concentrated fire of the enemy, and she was struck by at least fourteen 12-inch shells. The record of the damage done by a 12-inch shell that struck the conning tower shows how completely a modern warship may be disabled by a single well-placed shot. All the inmates of the conning tower were killed or disabled; the wheel was turned hard to port, and jammed in that position, causing the ship to leave the line and commence running in a circle; the compass was destroyed; the electrical wiring for signals was destroyed, and the engine room telegraph was broken. The smokestacks were so badly blown apart, with consequent loss of draft, that the ship could only make four or five knots, and this with a big coal consumption and the emission of vast volumes of smoke. In spite of the many hits made by 12-inch shells, the armor was nowhere penetrated, nor were any of the guns that were emplaced behind armor disabled. The article, which is too long for insertion or even lengthy review in the SCIENTIFIC AMERICAN, will prove particularly interesting as a study of ironclads in action.

THE SECOND EXTENSION OF THE SUBWAY.

The granting by the Rapid Transit Commission of a franchise for the construction of a subway below Sixth Avenue to Thirty-third Street, and below Ninth Street to Fourth Avenue, marks the second addition to the original rapid transit system, and it is logically the next extension that should be made. That portion of the subway now in operation serves Manhattan Island and the Bronx. The extension, which is under construction and about half completed, running from the City Hall in Manhattan to Flatbush and Atlantic Avenues in Brooklyn, connects the Manhattan system with Long Island; and the extension for which franchises have just been granted will give similar connection between Manhattan and New Jersey. These two subways will be practically extensions of the New Jersey trolley system, connection being made by way of the tunnel below the North River from Jersey City to Christopher Street. The New York & Jersey Railroad Company, the builders of the tunnel, will extend their lines as a double track system from the tunnel terminus at Greenwich and Christopher Streets below Sixth Avenue to Thirty-third Street and from the same terminus to Fourth Avenue. The franchises will run for a first period of twenty years, and then there will be a re-valuation of the terms on which they are to be continued. The tunnels are to be 40 feet below the surface, to permit the building of municipal subways above them, and the entrances will be made under private property, so as to avoid the encroachment of entrance kiosks upon the sidewalk space. The city reserves the right to acquire the tunnels at the end of twenty years at an appraised value.

A new method of laying electric cables has been adopted in the Poplar district of London, in lieu of the general system of inclosing the cable in an iron or earthenware conduit. The cables are laid separately in a corresponding number of light steel pipes. These pipes are coated upon the exterior with a special preparation in which paraffin wax predominates. They are made in 5-foot lengths, and are jointed by ends which screw into one another, leaving a flush surface, until a tube of 200 feet has been formed. This length of tubing is then laid in the trench, and covered all round with a layer of concrete, which is allowed to set. This accomplished, the steel pipes, which only serve as a mandrel on which to form the concrete duct, are withdrawn by the application of steam, which is driven into them under pressure. The heat thus applied melts the preparation around the pipes, and as this also acts as a lubricant, the pipes can be withdrawn quickly and easily by winch and rope. As each 5-foot section of piping is withdrawn, it is unscrewed and coated again for further use. By this ingenious process a concrete conduit of perfectly symmetrical form is obtained for the accommodation of the cables. These are drawn into the duct in the usual manner, the lubricant remaining inside considerably facilitating the operation. More than 100,000 feet of cables have been laid in this manner in Poplar, the process having proved completely successful.

The French submarine "X" has been launched at Cherbourg. This vessel constitutes one of the three experimental submarine vessels known as "X," "Y," and "Z" respectively, in which efforts are being made to combine the advantages of the submarine and the submersible, at the same time eliminating their disadvantages. Though of the same type and class, the three vessels are not uniform or of the same displacement, being relatively of 168 tons, 213 tons, and 202 tons. The submarine "X" measures 122.72 feet in length; beam, 10.23 feet; and draft aft, 7.54 feet. The vessel will be fitted with electric accumulators for propelling purposes when submerged, and gas or vapor engines for surface propulsion. The latter engines are to develop 220 horse-power, capable of giving a speed of 10.5 knots.

THE HEAVENS IN JANUARY.

BY GARRETT P. SERVISS.

If you step out of doors about 9 o'clock on a cloudless evening in the middle of January, and face the south, you will see before you the greatest of all the constellations, Orion. It is more than half way from the horizon to the zenith, and just east of the meridian. Whoever wishes to become acquainted with the finest display that the heavens afford, will do well to begin by fixing clearly in mind the outlines of Orion. It serves as a point of reference for the other constellations.

The first thing likely to arrest the eye is a beautiful row of three second-magnitude stars, nearly three degrees long, making the "Belt" of the giant figure which the ancients imagined here among the stars. The row slopes downward to the left. Above it, in a direction at right angles to the line of the Belt, and about nine degrees away, gleams a splendid first-magnitude star of a slightly reddish color, Betelgeuse, or Alpha Orionis, while on the lower side of the Belt, and at a similar distance, is another first-magnitude star, of piercing whiteness, Rigel, or Beta Orionis. Betelgeuse is in the giant's right shoulder, and Rigel shines on his uplifted foot, as Albrecht Dürer drew the figure for Flamsteed's Celestial Atlas.

Another second-magnitude star seven or eight degrees west of Betelgeuse marks the left shoulder. It is named Bellatrix, or the Amazon Star. A few degrees above a line drawn from Bellatrix to Betelgeuse is a little group of stars indicating the head.

Below the Belt, hanging straight down, nearly in a line with the head, appears another short row of small stars, the middle one of which has a hazy look. This is the Sword, and a telescope enlarges the hazy star into the grand Orion Nebula. About five or six degrees to the left of and below the point of the Sword is a lone third-magnitude star, Saiph, in the right knee. Betelgeuse, Belatrix, Rigel and Saiph mark the corners of a large trapezium, in the middle of which shines the Belt, and having once recognized this conspicuous figure, the observer will ever after know Orion.

Now, continue with the eye the line of the Belt downward and eastward, and at a distance somewhat more than twenty degrees you will encounter Sirius, by far the brightest star in the heavens. When near the horizon it is ablaze with prismatic colors, but as it rises higher the colors disappear, except for stray flashes like the rays from a fine diamond, and it settles down to a cold white core of luminous splendor. Prof. Newcomb estimates the actual luminosity of Sirius as thirty times that of the sun, but its spectroscopic constitution is different, and it is probably at an earlier stage of development. The striking figure formed by smaller stars southeast of Sirius marks the body of Canis Major, Sirius flaming in the mouth of the imaginary dog.

Directly under Orion's feet is the inconspicuous constellation of Lepus, the Hare. West of Lepus, wandering broadly over the sky, appears the long double-curve of Eridanus, the River Po, the line of its current being fairly well indicated by streams of small stars. Far over in the southwest, beyond the borders of Eridanus, is Cetus, the Whale, not very conspicuous at this season.

Returning to Orion and looking above him and westward, we see, almost overhead, Taurus, the Bull, whose charge the giant is figured as withstanding, with uplifted club in his right hand, over Betelgeuse, and with shield of lion's skin spread over his left arm, and indicated by a sprinkling of faint stars west of Bellatrix. The "horns" of Taurus project over Orion's head, and each is tipped with a fairly bright star in the Milky Way, which passes above Orion, from southeast toward northwest.

The head of Taurus is brilliantly marked by the V-shaped figure called the Hyades, whose brightest star, of the first magnitude, is the celebrated Aldebaran. This star is red, of a deeper hue than Betelgeuse. In actual luminosity it about equals Sirius, but being much farther away appears less brilliant to us. It may be remarked here that Rigel, according to Newcomb's estimate, is immensely greater than Sirius, and possibly exceeds the sun in light *ten thousand times!* But its distance is too great to be measured with our present means.

West of the Hyades appears the sparkling cluster of the Pleiades, in the Bull's shoulder. Here the figure of Taurus is abruptly cut off, and next westward comes Aries, marked by a pair of stars four or five degrees apart. Beyond Aries Pisces extends to the western horizon, with no conspicuous stars, but made notable just now by the presence of the planet Jupiter, and by the advance of Venus from the sunward side.

Away overhead, north of Orion and Taurus, another brilliant first-magnitude star, Capella, in the constellation Auriga, attracts our eyes. East of Auriga the stars Castor and Pollux, in Gemini, are seen shining about five degrees apart. Castor is the more northern and fainter one. Below them is seen the brilliant lone star Procyon in Canis Minor.

Following the Milky Way northwestward from Capella we see first the bending row of Perseus, with Algol hanging below; then the W-shaped figure of Cassiopeia; and south of Cassiopeia the row of second-magnitude stars in Andromeda, terminating in the northwest with the great Square of Pegasus. The Great Dipper is seen rising, bowl upward, in the northeast, while south of it is the Sickle of Leo.

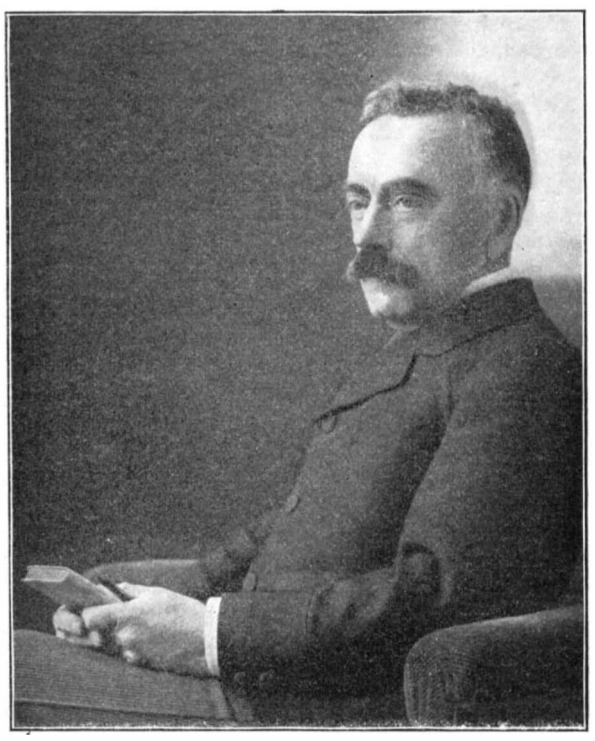
THE PLANETS.

Jupiter and Venus play the principal parts in the planetary display for January, and both are very brilliant. Saturn is also our evening star, but, having been in conjunction with Venus late in December, it is now drawing close to the sun and will disappear in his rays early in February.

To see Jupiter and Venus it will be best to choose an earlier hour than that selected for the constellations —say between 7 and 8 o'clock. Between 6 and 7 would be even better.

Jupiter remains in Pisces, moving very slowly eastward, but Venus which, on the 1st of January, is in Capricornus, rapidly swings away from the sun, advancing by the 15th to the center of Aquarius, and entering Pisces before the close of the month. She seems to be hastening to overtake her great brother, and her brightness grows from night to night as she hurries eastward. On the 1st she hardly outshines Jupiter, but as more and more of her illuminated surface comes into view from the earth, and as, at the same time, she gradually draws nearer, her superiority in brilliance to her really greater but more distant rival, will become strikingly evident. To watch these two planets through January will be an object lesson in celestial motions.

Mercury is in the morning sky, at greatest elongation from the sun on the 22d. Mars is also a morning star, in the eastern part of Virgo, rising about 1 A. M. in the middle of the month.



WILLIAM GILSON FARLOW.

Newly-elected President of the American Association for the Advancement of Science.

THE MOON.

New moon occurs on the 5th about 1 P. M.; first quarter on the 13th, about 3 P. M.; full moon on the 21st, about 2 A. M.; and last quarter on the 27th, about 7 P. M. The moon is farthest from the earth on the 12th and nearest on the 23d. The lunar planetary conjunctions occur as follows in Washington mean time: Mercury, January 4, 5:52 P. M.; Saturn, January 8, 8:41 A. M.; Venus, January 9, 10:06 A. M.; Jupiter, January 13, 10:33 A. M.; Neptune, January 19, 8:53 A. M.; Mars, January 27, 4:34 P. M.; Uranus, January 31, 9:22 P. M.

The interesting discovery of a "rill," or "crack," eighty miles in length, lying in the axis of the great lunar Valley of the Alps, is announced from the Lick Observatory. This may have been the bed of a river.

WILLIAM GILSON FARLOW.

BY MARCUS BENJAMIN, PH.D.

Botany has always been a favorite study in this country, and there have always been masters to teach it. Throughout the English-speaking world, whether in our own country or abroad, the standard textbooks on botany are still those written by Asa Gray. Before Gray, John Torrey, whose researches extended into other sciences as well, for he was equally distinguished as a chemist, was the great authority. These two men have filled the high office of President of the American Association for the Advancement of Science, and this year, at the Philadelphia meeting, William Gilson Farlow, one of Gray's pupils, and easily the foremost writer upon cryptogamic botany in the United States, will be inducted to that office, an election to which has come to be recognized as the highest honor that can be conferred upon a man of science in this country.

Prof. Farlow was born in Boston, Mass., on December 17, 1844, and after the usual preliminary studies entered Harvard College, where he was graduated in 1866. He then spent four years in the medical department of that university, taking the degree of Doctor of Medicine in 1870. Having determined to devote himself to the study of botany, he then went to Europe, where he spent some time under the celebrated Henri A. de Bary at the university in Strasburg, and later studied under Eduard Bornet and Gustave Thuret in Paris.

In 1874 he returned to the United States, and was appointed adjunct professor of botany at Harvard, and five years later was given the chair of cryptogamic botany, which place he still fills, being now in length of service the senior professor in the Department of Botany of Harvard University.

It is difficult to speak of his many investigations, but they have been principally devoted to marine algæ, fungi, diseases of plants, and kindred subjects, the results of which are included under the following titles: The "Potato Rot," which appeared in 1875; "Diseases of Olive and Orange Trees" a year later; and in 1880 he published a paper on "The Gymnosporangia," which was followed by "The Marine Algæ of New England" in 1881; then on "Some Species of Gymnosporangium and Chrysomyxa of the United States" in 1885, and during the same year one on "Some Injurious Fungi of California," in which State he spent nearly a year, and some notes on "Arctic Algæ" in 1886.

Prof. Farlow has made studies in his specialties for the United States Fish Commission and the Massachusetts Board of Agriculture, the results of which have appeared in the reports of these bureaus. In the prosecution of these investigations Prof. Farlow has traveled extensively in this country and in Mexico, as well as in Europe.

In recent years, especially since the death of Prof. Gray, his professorial duties have largely increased, and his leisure has been devoted to the preparation of textbooks, especially one on Cryptogamic Botany which has been long expected. Its exact title is to be "Introduction to Cryptogamic Botany, both Structural and Systematic." Prof. Farlow must also be credited with the authorship of the accounts of the "Progress of Botany" which have appeared in the annual reports of the Smithsonian Institution during the years from 1879 to 1886. He also prepared the review of the botanical work of that institution that appeared in the sumptuous volume published in celebration of the completion of the first fifty years of the Smithsonian Institution in 1897.

Prof. Farlow is an active member of many scientific societies both in this country and abroad, including the American Academy of Arts and Sciences, and in 1897 he received an election to the National Academy of Sciences. He represented Harvard in the gathering of scientific men in Glasgow in 1901, and on that occasion received the honorary degree of LL.D. from the university there. On the installation of President Van Hise of the University of Wisconsin in 1903, Prof. Farlow was again made the recipient of the honorary degree of LL.D.

He has been an active member of the American Association for the Advancement of Science since the meeting held in Indianapolis in 1871, and was advanced to the grade of fellow in 1875. His interest and constant attendance at the meetings led to his election in 1897 to the vice-presidency over the Section of Botany, and at the meeting held in St. Louis during convocation week (1903-4) he was the unanimous choice of the members for the presidency of the association.

In addition to John Torrey and Asa Gray, who served as presidents of the American Association in the years 1855 and 1871 respectively, George Lincoln Goodale presided over this great organization at the Indianapolis meeting in 1890, and now to these three great names in American botany his associates in science have regarded the work of William G. Farlow as meriting his election to the highest honor it is within their power to confer upon him.

TO OUR SUBSCRIBERS.

This is the last issue of the year—the fifty-ninth of the SCIENTIFIC AMERICAN's life. Since the subscription of many a subscriber expires, it will not be amiss to call attention to the fact that the sending of the paper will be discontinued if the subscription be not renewed. In order to avoid any interruption in the receipt of the paper, subscriptions should be renewed before the publication of the first issue of the new year. To those who are not familiar with the SUPPLEMENT a word may not be out of place. The SUPPLEMENT contains articles too long for insertion in the SCIENTIFIC AMERICAN, as well as translations from foreign periodicals, the information contained in which would otherwise be inaccessible. By taking the SCIENTIFIC AMERICAN and SUPPLEMENT the subscriber receives the benefit of a reduction in the subscription price.

MOVING A BRICK HOUSE BY WATER.

BY G. P. BLACKISTON.

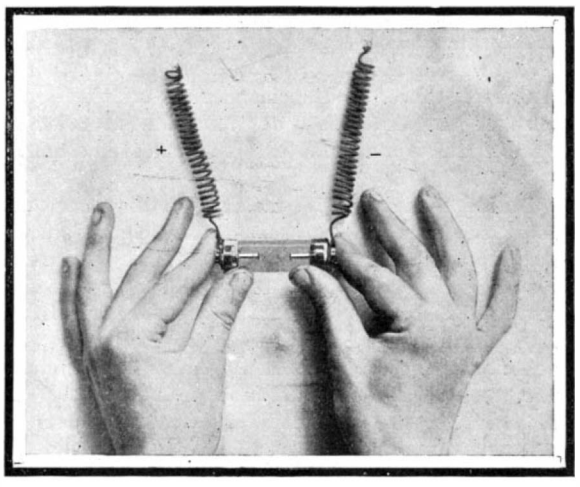
A few months ago we described and illustrated the lifting of a large brick mansion one hundred and sixty feet up the face of the steep cliffs that border the Allegheny River, near Pittsburg. We now illustrate another remarkable feat of house-moving.

The subject in question is the removal of a large two-story brick building, sixty years old, weighing over two hundred tons, from its former location at Sharpsburg, a suburb of Pittsburg, to the food product establishment of the H. J. Heinz Company in Allegheny, a distance of nearly four miles. This in itself is a very clever piece of work; but to make it all the more wonderful, most of the work was performed upon the water.

From the moment the house was lifted until it was placed upon its new foundation, there arose one complication after another. The long stretch of ground lying between it and the river was of such a soft, marshy nature, apparently without bottom, that the building was constantly in danger of collapsing; but even when these obstacles were overcome, and the house placed upon the shore of the river, a very severe flood rose, surrounding the house to a depth half way to the second story, and placing it in midstream. In order to prevent it from being washed away, the blocking and rollers had to be weighed down with immense beams and steel rails. The rushing waters abating sufficiently, the house was moved and lowered upon a large coal barge. This being done, and everything made ready, it was gradually towed down the Allegheny River, but due to the four low bridges between it and its destination, the barge had to be scuttled before passing each bridge, the water being pumped out afterward. To add to the excitement, it had to be lowered through a lock; and even when the river trip was completed, three tracks of the Buffalo, Rochester & Pittsburg Railroad had to be crossed within thirty minutes.

A SIMPLE POLARITY INDICATOR FOR INDICATING THE NEGATIVE POLE OF AN ELECTRIC CURRENT.

As is well known to electricians, the operation of determining the poles of a battery is not always an



A SIMPLE POLARITY INDICATOR FOR INDICATING THE NEGATIVE POLE OF AN ELECTRIC CURRENT.

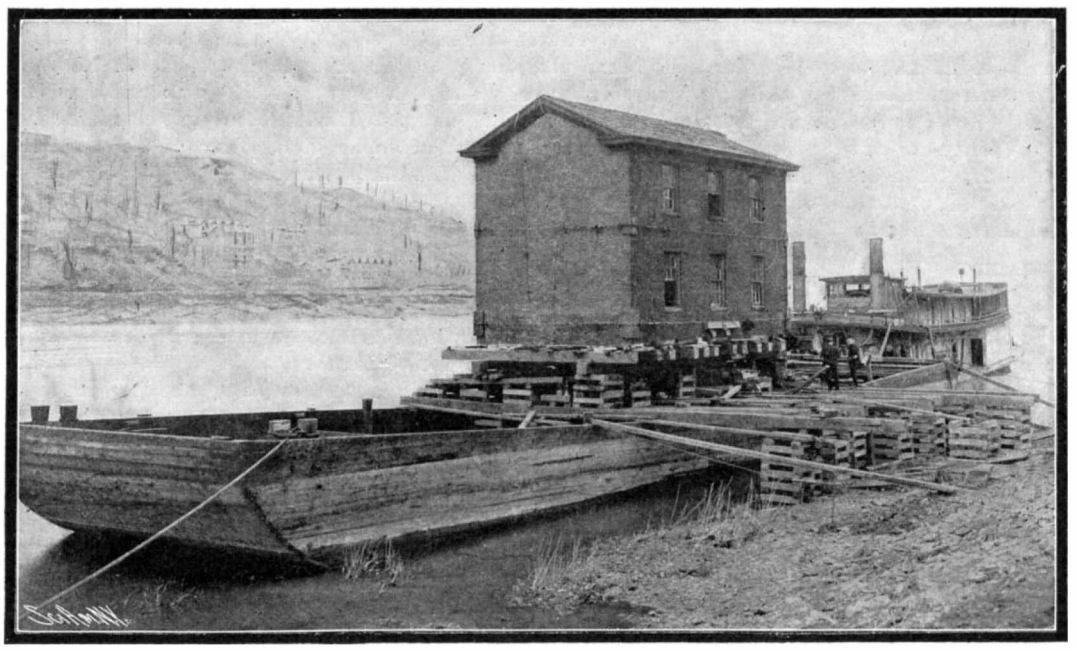
easy one to perform. A galvanometer is perfectly well adapted for the purpose, but is not very practical. The trouble with pole-paper and common blue-print paper is that both have to be moistened. A simple pole-tester, which can be had from any good electrical supply house, is shown in the illustration above. It consists of a glass tube closed at the two ends by a metal cap which is provided with a binding screw and a short internal metal rod. For the determination of polarity, the apparatus is put in circuit, and the liquid that it contains immediately becomes red at the negative pole. After the operation is finished, the tube is shaken to cause the color to disappear.

It is evident that after a certain number of determinations the liquid will have become too red to be any longer serviceable. All that has to be done in such an event is to empty the tube and fill it with fresh liquid. This very simple, and consequently inexpensive, apparatus is particularly well adapted for the use of automobilists, motorcyclists, and electricians, and, in general, of all those who, for one reason or another, have to determine electric polarities.

A STRANGE HOME.

BY CHARLES F. HOLDER.

A number of years ago a gentleman, who owned a farm near Baltimore, sent me word that he had a curiosity on his place which he wished me to see; and during my visit there he took me out into the field, leading the way to a clump of bushes, in the center of which was a hole two feet across, from which smoke was rising. The owner whistled or made some signal, upon which came first the woolly head, then the form of an old negro, who could well have posed as a gorilla, so remarkable were his features. The man, it appeared, insisted on living like a gopher in this hole, which I was assured was about five feet high by ten feet in length, being protected from the rain by a wooden cover. The man was allowed this ground rent, and fed by the landowner. He built a fire in the hole, and existed in a smoke that would doubtless have killed a white man; yet he lived here winter and summer, an existence far below that of any cave dweller of which there is any knowledge, without the comforts, so to speak, of the gopher and other burrowing animals, which have various apartments and sleeping rooms, warm and dry.



MOVING A BRICK HOUSE BY WATER.

The ground home suggests itself to numbers of persons as being already made. Holes or caves are utilized and adopted. Such a home of a very interesting native is to be seen on the island of Santa Cruz, off Santa Barbara, California. Here the oldest home on the island is underground, and has been occupied for many years. A yellowish sandstone cliff has been worn out by the wind and weather into rooms similar to those found in the various cañons, one of which may be seen on the left of the accompanying photograph. The road passes directly along the cliff, and over the excavation, which is ten or twelve feet long and fifteen or more wide, forming a commodious room for the one man who has lived there, it is said, seventeen years. By cutting the top of the entrance away he formed an arch, even this requiring but little labor. The opening was then closed by boards and braced or supported by scantling, two uprights forming a door; all being neatly whitewashed. On one side of the doorway a chimney was built of adobe bricks and mud, being on the outside after the fashion of the chimneys seen in Virginia. The top portion is a modern iron stovepipe, but a little roof of shakes is built out from it to keep the rain from the mud, brick, and stone chimney. The earth has been leveled twelve feet out from the door, and inclosed with a fence having a gate, all neatly whitewashed. Such is the cave house of a modern islander, whose dwelling is a cross between an ancient cave dwelling and a modern shanty. Earthquakes, and some heavy ones, have shaken the island, but have failed to affect it; its roof is the solid cliff partly beneath the roadway; and so far as creature comforts go, the occupant is contented in perhaps the strangest home of a white man in this country.

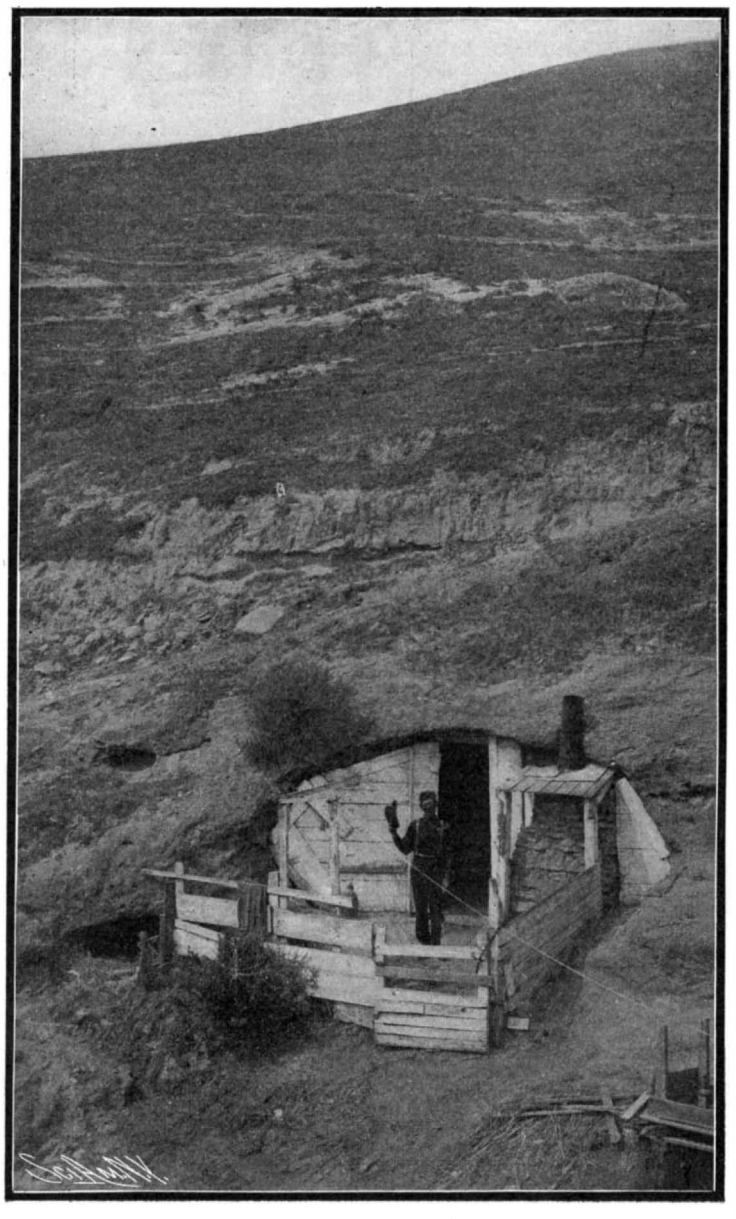
The gold-mining industry in Lapland has been closed, owing to the bad results obtained.

Novel Bridge Across the Wear.

A new double-deck bridge possessing several interesting features is to be thrown across the River Wear at Sunderland, England. The structure has been designed by Mr. C. A. Harrison, the engineer in chief to the North-Eastern Railroad, and is to be constructed by Sir William Arrol & Co., Limited, of Glasgow. The new bridge with its approaches will measure one and a half miles from end to end. The upper deck is to be used for the railroad, while the lower level will be utilized for road traffic. This arrangement has been adopted, as thereby the gradients from the thoroughfares on either bank, leading to the bridge approaches, are facilitated. The main river span will be of 350 feet, with a headway of 85 feet clear above high-water level at spring tides. There will be a 220-foot span on the south side, and two similar spans each of 220 feet on the north side, passing over shipbuilding works.

One of the most interesting features of the work will be in connection with the sinking of the caissons to carry the masonry piers. The river caisson will have to be sunk to a depth of about 90 feet. The weight of the steelwork in the main girder span will be from 2,500 to 3,000 tons. The girders are to be of the lattice type, and with a total depth of 42 feet. The main girders will be placed 26 feet apart, representing the width of the roadway. Upon transverse girders supported upon the main lattice members, about 20 feet above the bottom boom, will be carried a double railroad track. Sidewalks each 7 feet wide are placed on either side of the main girders, while gas and water mains are to be carried on the outer ends of these cantilevers. The construction of the bridge will have to be carried out upon the overhang system, as according to the contract there is not to be any obstruction in the fairway of the river at any period of erection. The cost of the structure is estimated at $1,500,000.

A good formula for aluminium silver is: 3 parts of aluminium and 1 part of silver. This alloy is very easy to work.



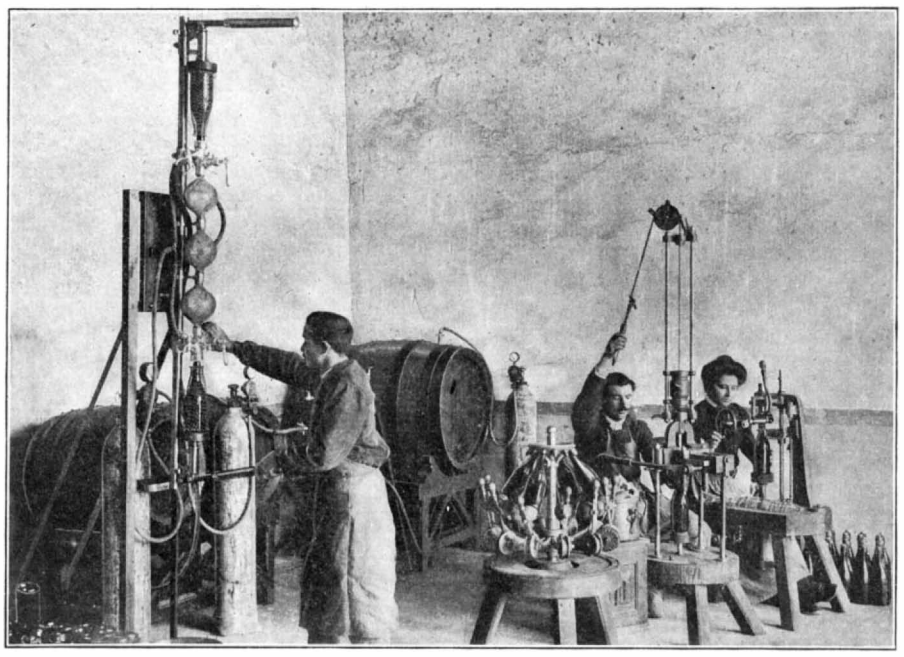
A MODERN CLIFF DWELLER.

NEW APPARATUS FOR CHAMPAGNIZING WINE.

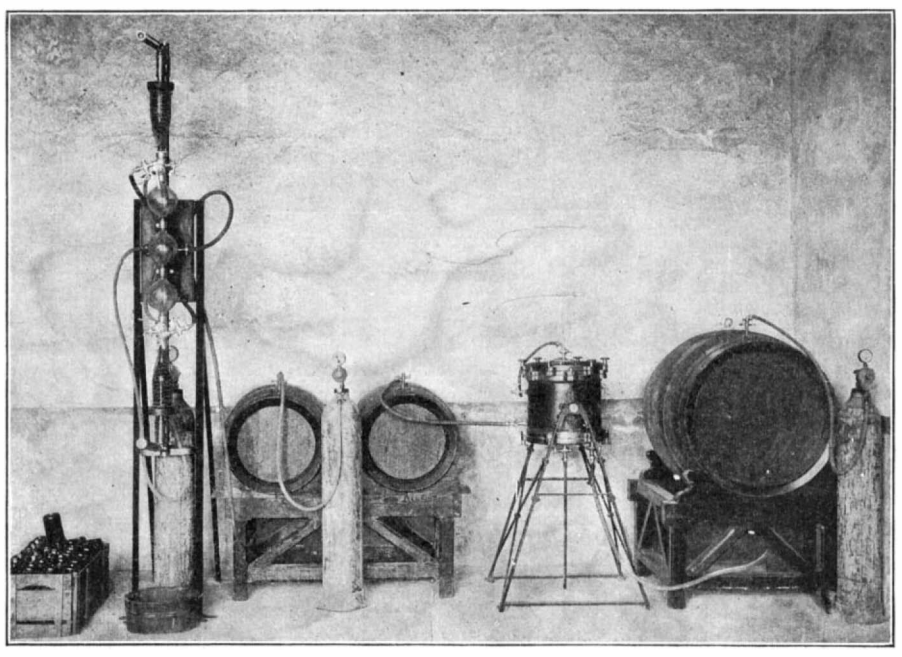
M. René le Grand, of Marcey, has recently invented a very interesting apparatus by which wines are rapidly "champagnized" without resorting to the complicated processes that have hitherto been employed. The apparatus is christened the "Moussogène" ("froth-generator"), and is used by the inventor for champagnizing his wines in order to render them salable at more remunerative prices. It consists of a steel tube, which revolves upon a pivot, and to which are adjusted glass globes connected at each end by distributing valves of silver-plated bronze. Under these latter, through levers placed at the top and bottom of the apparatus, the bottles to be filled are compressed. These globes, which serve as carbonic acid collectors, are constantly supplied by a cylinder filled with the gas.

The wine, prepared in advance, is contained in a cask that communicates with the apparatus through a special tube. Upon this cask is exerted a slight pressure of carbonic acid flowing through the tube. This pressure prevents access of air to the liquid and causes the latter to ascend to the bottle without any shock. Upon slightly opening the cock whereby the globes and bottles are placed in communication, and pressing the lever already mentioned, the carbonic acid immediately expels the air from the bottles and sterilizes them. The bottles are then filled by manipulating the cocks that break or establish communication with the tube through which the wine from the cask flows. The apparatus is then turned over so as to cause the bottle occupying the upper position to take the place of the one occupying the lower. The wine, descending by its own gravity in a thin stratum of a wide surface, successively traverses the collectors charged with carbonic acid and flows frothing into the lower bottle. The operation is continued in the same way with the following bottles and consumes but 45 seconds. The saturation is so perfect, it seems, that the corking can be effected without any haste. This apparatus permits of converting still wines of all kinds into sparkling ones, and, at the same time, of preserving their particular qualities. It is applicable to other beverages, such as beer, cider, milk, etc. It has the advantage of being simple and practical for each.

The claim made for it that it first sterilizes the bottles needs verification, since the carbonic acid, under the conditions in which it is applied, can, it would seem, exert but a very slight antiseptic effect.



Admitting the Carbonic Acid Gas and Corking and Sealing the Bottles.



APPARATUS FOR CHAMPAGNIZING WINES.

near Zürich, an apparatus which is simple in design and which requires little supervision.

The apparatus is made in sizes up to 30 horse-power for connection with a direct current circuit up to 250 volts. A number of cells are connected in series, the electrodes of which are cast iron and arranged as are the plates of a filter-press. Between the electrodes are resistant diaphragms, serving at the same time to insulate and to stiffen the plates. The gases produced at the surface of the electrodes pass through openings in the plates into two separate pipes, by which they are conveyed into the separators together with the liquid. Here the gases are separated from the liquid, the latter being carried back by a common pipe into the chambers of the apparatus. Thus by means of the gas generated in the chamber an automatic circulation of liquid is effected as the circuit is closed. The electrolyte of the apparatus is a 10 per cent solution of potash, in distilled water, which is not altered in course of operation; the decomposed water, however, must be replaced by distilled water. As regards gas pressure, the normal construction renders it possible to supply gases under pressures up to 2½ meters of water.

When operated for a period of twenty-four hours, the apparatus must be cleaned about every eight weeks. No supervision is necessary during operation apart from the renewal of water.

An apparatus yields per kilowatt hour 168 liters of hydrogen, 84 liters of oxygen, decomposing 134 grammes of water. When used warm the output is about 8 per cent higher. Temporary overloads as high as 20 per cent are readily supported.

As regards the purity of the gases, the oxygen is 97 per cent pure and contains a little hydrogen and carbon monoxide. The hydrogen contains 99 per cent of pure hydrogen and about 1 per cent oxygen.

The tension required per chamber of the cold apparatus is about 2.7 volts. After the operation has gone on for about eight hours, the apparatus attains with about 60 deg. C. (140 deg. F.) its maximum temperature, when 2.3 volts only will be required per chamber.

In order to produce 1 cubic meter of oxygen and 2 cubic meters of hydrogen, about 12 kilowatt hours are necessary, the price of the gases being mainly dependent on the price of the power. The price of the power according to conditions prevailing in Germany varies from 0.2 cent per kilowatt hour in the case of economical hydraulic power up to 6 cents and more in the case of a small steam plant. When taking an average rate of 1 cent per kilowatt hour, 1 cubic meter of oxygen (with 2 cubic meters of hydrogen obtained at same time) will cost 12 cents; 1 cubic meter of hydrogen (with ½ cubic meter of oxygen simultaneously obtained), 6 cents; and 1 cubic meter of mixture, 4 cents.

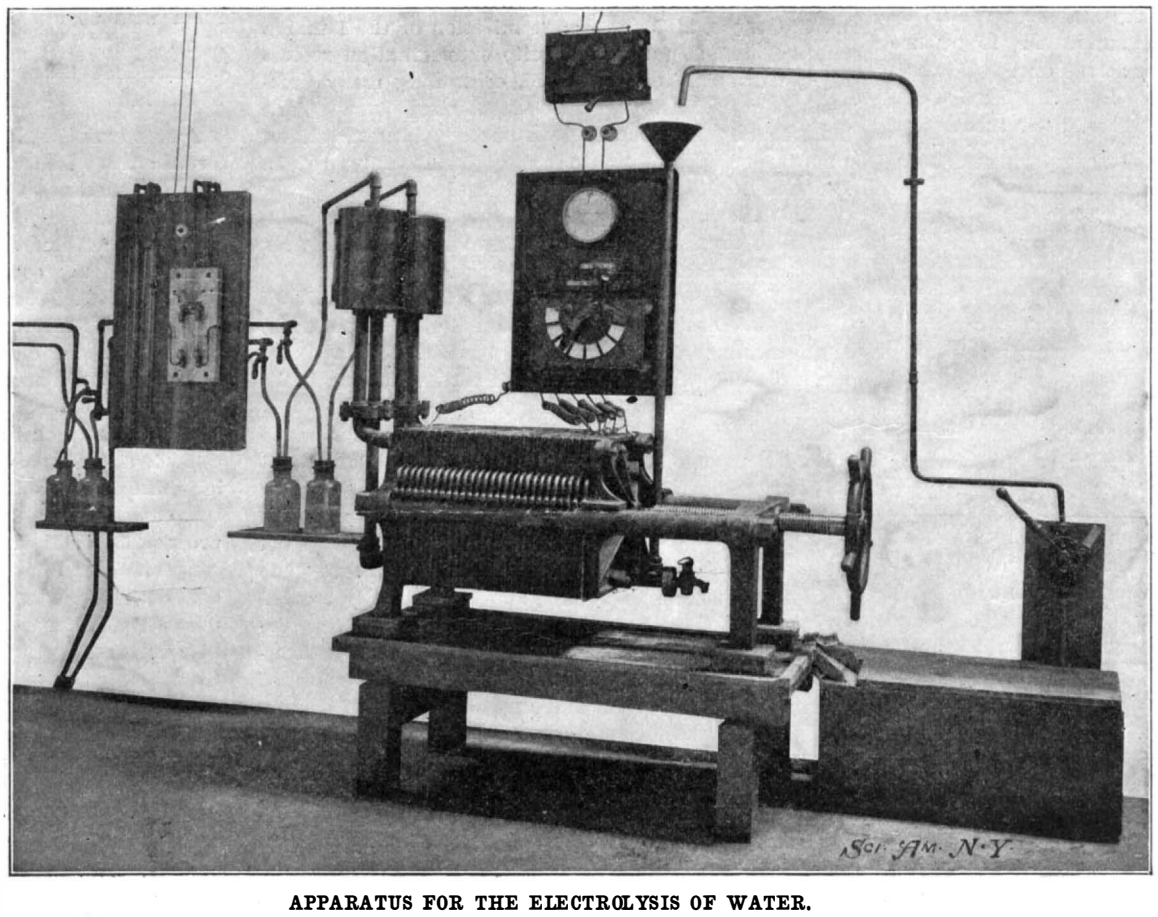
A NEW FORM OF APPARATUS FOR THE ELECTROLYSIS OF WATER.

BY DR. ALFRED GRADENWITZ.

The electrolysis of water by the electric current has been known for more than one hundred years, but not until the electric current could be generated on a more extensive scale and supplied cheaply was it possible to prepare oxygen and hydrogen on a commercial basis.

At present water is decomposed in iron vessels having iron electrodes, alkali electrolytes being employed. Most of these apparatus, however, require considerable space and are very inconvenient on account of insulation, elaborate connections, and gas pipes they require when a certain number of cells are connected in series.

These drawbacks are avoided by an apparatus for the electrolysis of water designed by the Maschinenfabrik Oerlikon



APPARATUS FOR THE ELECTROLYSIS OF WATER.

Voltage, 65; amperage, 30; output per kilowatt-hour: 168 liters of hydrogen, 84 liters of oxygen.

Mylius Ericksen's expedition, after two years and a half spent in exploring Greenland, has returned with some valuable ethnographical and scientific records, the explorers having lived with the natives and studied their language and customs. The Ericksen expedition was last heard from May 21, at the Danish colony of West Greenland, where it had arrived after much hardship and suffering. Whalers which had arrived at Dundee on November 16, 1903, reported that they had found the expedition on Saunders Island in a pitiable state of destitution. Count Moltke, the artist of the expedition, was very ill at that time. The explorers, in the company of Eskimos, were living in a tattered tent, and their food was almost exhausted, their reliance being upon eggs, which were to be found in good supply on the island. They had only one gun, and had abandoned their boat and one sledge at the northern part of Melville Bay. The whalers left them supplies.

THE LEBAUDY AIRSHIP "LE JAUNE."

The essential characteristic of the "Lebaudy II." ("Le Jaune") as well as of the "Lebaudy I." is stability. The idea of making airships stable by means of aeroplanes, which is a characteristic of the Lebaudy craft, is by no means new. It has been mentioned in patents on several occasions, but it was only in the Lebaudy patent of May 8, 1903, that the means employed in the "Jaune" for making the airship stable were brought forward for the first time—means which have certainly contributed to the exceptional stability of this aerostat.

In this patent the Messrs. Lebaudy show the coexistence of two species of plane surfaces, the one a horizontal, to establish a horizontal or flat stability, and the other a perpendicular plane, to endow the airship with constancy in the vertical plane. Although both species of planes are mentioned together, the means of producing the horizontal stability are the ones upon which the greatest dependence is placed. As a matter of fact, the efficiency of these planes increases with the velocity of the ship. Several planes for attaining different positions have been fixed upon the long keel, which formed a sort of a feathered tail. The direction of these planes, and even their surfaces, may be changed, but not during flight; otherwise they would constitute merely a bundle of little rudders. Here is an example of the construction of these directing planes, destined to keep the ship upon an even keel. The make-up of the other planes is analogous. It must first be stated, however, that the basket is soldered to a steel cylinder, solidly braced and rendered non-breakable by interwoven steel wires, thus constituting a stiffening system of great strength. This cylindrical tube is of oval shape, having a diameter of 95 feet in one direction and 19.68 feet in the other. The directing plane, of which we shall now speak, is formed by a tube extending over a semi-oval, soldered upon the tube and made solid, in the same manner as the oval cylinder, by braces and steel wires. This plane is 95 feet long, with a height of 4.23 feet, affording a surface of 172.16 to 193.68 square feet. It is situated about 16.4 feet below the center of gravity of the balloon, which will permit us to estimate its efficiency. The prospective "Lebaudy," which will make ascensions next year, will have, however, both fixed and movable planes, adapted to both horizontal and vertical motion; moreover, the screw propellers will be provided with jointed wings. It must not be overlooked that the "Lebaudy II." is a trial ship, and that the pilot Juchmès must have at his disposal several means of procuring the requisite stability of his ship during flight, so that he may choose that which offers the greatest advantages.

The "Lebaudy II.," having no need of ballast, may without inconvenience make ascents of 6,500 feet, a circumstance that offers many considerable advantages. First of all, the pilot has more latitude in the choice of a more favorable current of air or in the avoidance of unfavorable currents. Again, from this height he can examine the surface beneath him, comprised within a circle having a radius of 74.5 miles. Still another good quality possessed by the "Jaune" is that of preserving its shape.

Examination of Applicants for the Panama Canal.

On January 18, 1905, the United States Civil Service Commission will hold an examination to secure eligibles for vacancies. The positions on the Isthmus of Panama to be filled under the Isthmian Canal Commission are assistant civil engineer, instrument man, transit man, level man, rod man, chain man, helper.

Assistant civil engineers must not be younger than 25 nor older than 50. They will receive salaries ranging from $200 to $250 per month. Seven years' practical experience in civil engineering are necessary, not less than one year of which must have been on civil engineering construction work. A course in civil engineering will be taken as the equivalent to four years of this period.

The age limit of an instrument man is 25 to 50 years; the salary is $175 per month.

The position of transit man carries with it a salary of $150 per month. Applicants must not be less than 21 nor older than 50 years. Five years' practical experience in the use of instruments and surveying is necessary. A college graduate's course in civil engineering will be accepted as the equivalent to three years of the period stated.

A level man will receive from $100 to $125 per month. The age limit is from 21 to 45 years. The requirements are the same as for an instrument man, except that applicants will not be required to have had more than three years' practical experience in the use and care of instruments in surveying. Three years' study in a school of civil engineering will be accepted as the equivalent of two years of the required experience. After one year's satisfactory service in this grade, appointees will be eligible to promotion to transit man without further examination.

A rod man will receive from $75 to $83.33 per month. The age limit is 18 to 40. Applicants over 20 years of age, however, will be preferred in appointment. At least one year's practical experience in similar work is necessary. Two years' study in a school of civil engineering, however, will be accepted as the equivalent of this experience.

The chain men must not be less than 18 or over 40 years of age. The requirements of the examination are the same as for rod men.

Helpers will receive $50 per month. They must not be less than 18 or over 40 years. They will be examined in accordance with the instructions governing the examination of rod men.

The examinations for the various posts mentioned are open to all citizens of the United States who comply with the requirements. What these requirements are, are stated in application form No. 1312, which will be furnished gratuitously by the United States Civil Service Commission, Washington, D. C. Form No. 1237 gives a list of places where examinations will be held, and likewise the subjects in which examinations will be conducted.

St. Louis Fair's Total.

The official report of the Director of Concessions and Admissions of the Louisiana Purchase Exposition, made public, shows that the total recorded admissions for the period of the Exposition, from April 30 to December 1, inclusive, was 19,694,855, of which 12,804,616 were paid and 6,890,239 were free.

The free admissions included from 20,000 to 30,000 workmen who were admitted daily for several weeks to complete the work of construction of buildings and installation of exhibits. In the recorded admissions Sundays are not taken into account, that day having no relationship to the official admission records of the Exposition.

The total admissions at the World's Columbian Exposition at Chicago were 27,539,041, of which 21,479,661 were paid.

American Mosquito Extermination Society.

Under the new title, in place of "National," the second annual convention of the above-named society occurred in this city and Brooklyn, December 15 and 16 last, and a permanent Executive Council was chosen, consisting of the previous provisional council. The first meeting was held on the afternoon of the 15th at the New York Aquarium, where the process of mosquito hatching was shown by living examples, and the species of fish who swim near the surface and enjoy the mosquito for food. The director of the Aquarium kindly provided these exhibits. After a few remarks by the chairman and the reading of reports, the greetings of the society were extended to Major Ronald Ross, M.D., of Liverpool, England, recipient of the Nobel prize for the discovery of certain relations between special species of mosquitoes and malaria.

Mr. Frank Moss read an amusing paper on "The Criminal Indictment of the Mosquito." Suggestions as to the adoption of uniform State laws pertaining to mosquito extermination and State aid to boards of health were made and discussed.

The evening session was held in the art rooms of the Brooklyn Institute in Brooklyn. Dr. L. O. Howard, of Washington, D. C., was to preside, but was prevented in consequence of a call elsewhere. A paper by Col. W. C. Gorgas, M.D., on the "Sanitation of the Panama Canal Zone," so far as mosquito extermination relates to it, was submitted and read, containing many practical suggestions. "Diversities Among New York Mosquitoes," illustrated by numerous lantern slides, was the subject of an interesting address by Dr. E. Porter Felt, New York State Entomologist.

The third session began on the afternoon of December 16 in the Brooklyn Institute rooms, presided over by Dr. John D. Smith, of New Jersey.

Dr. Walter Wyman, Surgeon-General, and Dr. J. M. Roseneau, Director of the United States Washington Hygienic Laboratory, explained by means of striking lantern slides the "Methods of Examination and Dissection of Mosquitoes for Parasites."

Dr. Thomas Darlington, Health Commissioner, made an address on "What New York City is Doing and Might do Toward Mosquito Extermination."

The fourth session was held in the evening in this city in the hall of the American Institute on 44th Street, Vice-President Walter C. Kerr presiding. "The Mosquito Question," popularly and scientifically treated by Dr. Quitman Kohnke, president of the New Orleans, La., Board of Health, proved to be a very entertaining and instructive lecture. Living examples of the mosquito wigglers were projected on the screen, and the effect of oil and permanganate of potash as regards extermination illustrated. It was shown that potash had no effect at all, but that oil suffocated by stopping the air-breathing tube. Examples of the yellow-fever mosquito were shown, and the method of the transmission of the fever germ taken from one fever patient to the next victim, as well as the effect of the poison on the blood-corpuscles. The duties of boards of health were well explained, and the absolute non-infection of yellow fever by contact was proved. Altogether, it was a thorough explanation of the causes of the extension of yellow fever. The paper will appear in full shortly in the Scientific American Supplement.

Mr. Cornelius C. Vermeule, C.E., concluded the evening by an interesting paper on "The Relation of Mosquito Extermination to Engineering and Public Improvements."

Automobile Notes.

Following the example of the two English tests, M. Maurice Fournier is endeavoring to run an Oldsmobile runabout 4,000 miles in France. The start was made the 26th ultimo, and at the last report was progressing favorably.

Fifty miles in 48 minutes 39 1-5 seconds is the fastest long-distance track record that has ever been made. This time was made at Fresno, Cal., on the 13th inst., by Barney Oldfield on the Peerless 60-horse power "Green Dragon" racer, and it was 7 minutes 2 4-5 seconds faster than the record made by a Winton racer on October 19 last. In the course of the speed trial Oldfield reduced by 2 seconds his former record for 15 miles, thus making it 14:03, and placed the figures for 25 miles at 23:38 1-5, which was a reduction of 20 4-5 seconds.

The Fifth Annual Automobile Show will be held in Madison Square Garden, this city, from the 14th to the 21st of January. So great has been the demand for space this year by American exhibitors that most of the foreign cars have been crowded out, and these will be exhibited in the hall on the top floor of the Macy building during the same week. New York will consequently have two automobile shows of the finest American and European cars at the same time, and that it will be a busy week for the sightseer and prospective purchaser goes without saying.

Following the successful completion of a 3,000-mile tour made in Great Britain by an Oldsmobile runabout and touring car, Capt. Deasy, the agent for the Swiss Martini car in London, undertook a 4,000-mile reliability run. The distance was successfully covered in 22 days, and of the involuntary stops two of 8 and 9 minutes respectively were due to broken chain bolts; two others of 10 and 16 minutes were needed to thaw the lubricator; and one of 8 minutes to clean the carbureter jet. The longest stop was that lasting 11 hours and 25 minutes, during which the differential pinions were replaced. The car was "officially observed" by members of the Automobile Club, and its performance was certainly meritorious considering the time of the year.

In order to always assure the immediate lighting of the acetylene headlights in an automobile, as well as to do away with the troublesome generating apparatus for producing the gas, a seamless steel tank, heavily copper-plated and highly polished, and having brackets for readily attaching it to any machine, has been placed upon the market. The cylinder is 20 inches long by 6 in diameter and weighs 20 pounds. One head of the cylinder is sunken sufficiently to allow of a pressure gage being placed in the space thus obtained at that end, while the gas is piped to the burners from the other end of the tank. This reservoir may be filled with 50 cubic feet of compressed acetylene gas at a cost of $2, and it will supply two lamps fitted with one-half-foot burners (the size generally used with 8-inch reflectors) 50 hours.

An international reliability trial will be held in France from February 18 to 25. A total distance of 1,400 kilometers (869.4 miles) will be covered in stages of 100 kilometers each, two of these stages of 62.1 miles being run off daily. Each day's run will be from Versailles into the country and back again. Entries for the test close February 1. Two hundred points per stage will be allotted for regularity; 250 points will be given for speed on hills per ton-kilometer; 50 points for quickness in starting the motor; while for stops for mechanical trouble of any kind or for the replenishment of water or fuel, 100 points per stop will be deducted, and 50 points per stop for tire trouble. The hill-climbing and brake-trial tests will be sprung on the contestants unawares, so that they will have no preparation. All cars must carry their full load of passengers. Points will also be given as follows: For comfort and elegance of the car and arrangements for protection against rain, 400; for accessibility of parts, 200; for ease and speed in applying the brakes and for their holding powers, 300; for springs, 100; for protection of mechanism from mud, 80; for ease of turning and absence of noise in changing speed; for flexibility of engine; for absence of vibration when running or stationary; for absence of smoke; and for position of muffler—50 points each. A maximum of 200 points will be awarded in each class to the lowest priced vehicle. The first three classes include cars not exceeding 1,000, 8,000, and 12,000 francs, and the fourth all cars above 12,000. No vehicle which does not cover the full 1,400 kilometers will receive an award.

Correspondence.

Photographic Method of Reproducing Pictures.

To the Editor of the SCIENTIFIC AMERICAN:

In reference to an article on this subject by Mr. Fairman in the SCIENTIFIC AMERICAN of December 10, the writer would like to make a few suggestions.

The *modus operandi* given in the above article, in short, was to take the picture to be copied, and, after rendering it translucent by giving it a light coat of paraffine, to make a negative of common printing paper from it by simple contact printing. Again, treating the negative thus made with paraffine, any number of copies of the original could be made from it.

Now it is evident that if the original picture or drawing is very valuable, a coat of paraffine would utterly ruin it, and where this is the case (as it was in the writer's experience) some other method should be resorted to. The picture to be copied was an old pen drawing. It was first placed with its face side against the coated side of an ordinary "fast" dry plate. The two were then placed in a printing frame, using a piece of plain glass to hold them in contact.

After exposure to ordinary lamplight, keeping the frame moving slightly to insure even exposure, the plate was given the usual development, resulting in a very good negative.

Some very good prints were made from this negative on aristo paper.

If printing is carried to the right point, very little of the effects of the unevenness in the texture of the paper of the original picture will show in the finished copy.

Pictures to be copied by this method must possess considerable contrast in order to give best results.

Morrill, Kansas. FRANK E. POISTER.

The Use of Kites for Meteorological Observations at Sea.

To the Editor of the SCIENTIFIC AMERICAN:

Since the article entitled "Meteorological Observatories at Sea," in your issue of December 10, will be widely read and probably copied by other journals, it seems proper to point out that the credit for first using kites to lift self-recording instruments over the water belongs here, and not abroad. You say: "Prof. Hergesell, chief of the Alsace-Lorraine Weather Service, was the first to use kites to carry self-registering instruments aloft over the water. His first experiments on the Lake of Constance, in 1900, were followed by some very successful ones made by Berson and Elias on a trip to the North Cape." The following extract from Prof. Hergesell's report to the International Meteorological Committee shows this statement to be erroneous. Prof. Hergesell says: "In July, 1900, I had the idea of using the speed of a boat to correct the wind conditions, and I made some experiments with a motor-boat [on the Lake of Constance], but without raising an instrument. In the month of August, 1901, Mr. Rotch, in America, was the first to lift an instrument in nearly calm weather by using a steamboat which he could maneuver at will."

While the motion of a vessel had been used before to create an artificial wind, or supplement the natural wind sufficiently to lift kites, I was ignorant of such experiments, and was led to try this method on account of the impossibility, on some days, of getting here meteorological observations in the upper air. Accordingly, on August 22, 1901, in nearly calm weather, with the wind too light both on Blue Hill and at sea-level to lift the kites, they were easily flown from a tugboat, specially chartered by me to cruise in Massachusetts Bay, and bore the meteograph to the height of half a mile. So far as I know, the resulting records of the barometer, thermometer, hygrometer, and anemometer were the first to be obtained from a kite flown from a moving vessel. To ascertain whether kites could be flown from a steamship pursuing its regular course, with an assistant, Mr. Sweetland, I made the voyage from Boston to Liverpool between August 28 and September 5, 1901; and, although nearly calm weather prevailed, the eastward motion of the vessel made it possible to fly the kites, with the attached meteograph, on five of the eight days occupied by the voyage. These instrumental data were probably the first at a considerable altitude over the Atlantic Ocean, and showed that in this way observations might be secured in all weather conditions, severe gales only excepted, provided the steamer from which the kites are flown is so maneuvered as to bring the wind to a suitable velocity. An account of these experiments was given in Science, and the observations themselves were published with the Blue Hill observations in Vol. XLIII., Part III., of the "Annals of the Harvard College Observatory." I also presented papers on the subject at the Glasgow meeting of the British Association, in 1901, and, the next May, at the Berlin meeting of the International Committee for Scientific Aeronautics, in both of which I proposed to extend the method to the investigation of the atmosphere over the tropical oceans.

My foreign colleagues were not slow to avail themselves of the idea, for the following summer Messrs. Berson and Elias obtained meteorological observations with kites on a voyage to Spitzbergen, while Mr. Dines did the same off the coast of Scotland. Prof. Köppen also experimented on the Baltic, where, in 1903, M. Teisserenc de Bort exceeded the great height of 19,000 feet with kites flown from a Danish gunboat. Since 1902, Prof. Hergesell has made monthly flights on the Lake of Constance, and this year he succeeded in inducing the Prince of Monaco (which I tried to do two years before) to employ the yacht, from which the Prince had been exploring the depths of the ocean, for soundings of the atmosphere. Some results obtained during a brief campaign in the Mediterranean and in the neighborhood of the Canaries are described in your article.

This, however, is but the beginning of the work, for the whole region between the Azores and Ascension needs to be explored; and soundings in these latitudes up to a height of two or three miles, through the doldrums and trade winds, would help to solve some of the most important problems in meteorology and physical geography. The following resolution, which was adopted at the Southport meeting of the British Association, gives authority to my views: "The International Meteorological Committee, in accordance with the decision, at Berlin, of the International Committee for Scientific Aeronautics, believes that the exploration of the atmosphere above the tropical oceans, by means of kites flown from a specially equipped steamship, an enterprise that was proposed by Mr. Rotch in 1901, is one of the most important meteorological investigations to be undertaken in the immediate future."

To charter and keep in commission for several months a properly equipped vessel would cost about $20,000, and I have made an unsuccessful application to the Carnegie Institution for a grant to defray a portion of this expense. The investigation is certain to be undertaken before long, but it ought to be done by Americans, who have developed the kite as a meteorological instrument, and if any of your readers will enable me to procure a suitable steamer, or ocean-going yacht, I am ready to furnish the apparatus and personnel necessary to carry out the project.

A. LAWRENCE ROTCH.

Blue Hill Meteorological Observatory, Hyde Park, Mass., December 16, 1904.

The Point of View of Some Contemporaries.

At this season of the year, when many subscriptions to the SCIENTIFIC AMERICAN publications are expiring and renewals for the coming year are being received, a vast number of letters are received by the Editor, which are often of a personal character, either commending or sometimes criticising the editorial work of the past year. Such letters are always welcome, even the few which are received of a critical character, provided it is seen that such criticisms are honestly given and with a purpose of improving the character of the paper itself.

One letter was recently received from a subscriber, whose first subscription dated back to 1846. We have a number of subscribers whose subscriptions date back to the late forties and early fifties.

The following letter, which was entirely unsolicited on our part, and which came in the ordinary course of a day's mail, was received from Mr. S. S. Knabenshue, Editor in Chief of the Toledo Blade:

"It may be of interest to you to know that, since 1871, I have been a regular reader of the SCIENTIFIC AMERICAN, and since its establishment, of the SUPPLEMENT. My five sons have been interested readers of both. Of these, three are deeply interested in scientific matters, and all engaged in electrical engineering. The oldest is an officer of the regular army; the youngest, a boy in his fourteenth year; A. Roy, the aeronaut, is my second son; Paul, who made the ascension in a gas balloon at the World's Fair in the interest of a wireless telegraph experiment, is the fourth son; Mark, the third son, is in charge of an electric light plant in New Mexico.

"I always had strong scientific leanings, and it is an interesting question how much heredity had to do with the bias of these three boys in that direction; and how much was due to environment; that is, the regular weekly reading of the SCIENTIFIC AMERICAN and SUPPLEMENT. As a purely personal opinion, reinforced by the knowledge which a father necessarily has of his sons and their education, I unhesitatingly say that your publications have been the determining factor, and I may say that the boys themselves agree with me."

Such testimony as this, from one who himself feels the cares and responsibilities of editorial work, is doubly appreciated. In similar strain comes a word of approval from the Editor of the Erie Echo:

"I regard the SCIENTIFIC AMERICAN as absolutely indispensable to any newspaper office, or to any man who desires to keep in touch with the scientific progress of the times."

Millinery "Chip."

It is not generally known that many of the handsomest summer hats worn by the ladies of this country are literally made from wood "shavings." The finest examples of this industry are produced in Japan, these wooden ribbons appearing in many forms, some of which have almost the delicacy and sheen of satin, while others resemble soft and dainty crepes. Only about fifteen per cent of the chip is exported in the form of wood ribbons, the remainder being worked into what is commercially known as chip-braid, and which is employed in the same manner as straw braid, that is, for hats, basketry, and other fancy articles.

The exports in a single year from Japan have amounted to over $650,000, the United States being a large buyer. The trade is steadily increasing, with a constantly-growing demand, as the industry is comparatively new. While willow is considerably used in Germany, the Japanese manufacturers employ European poplar, spruce, Chinese cypress, cherry, buckeye, paulonia, false hickory, and some other kinds of wood. The chip is produced by planing with special tools, the shavings being about fifteen inches long, and one and a half in width. The leading forms are known as crepe, thin crepe, striped crepe, scaly crepe, crimped crepe, network crepe, relief figures, pushed, undulated, etc. The product takes dyes readily, and is so thin and flexible that daintiest effects in millinery goods can be secured.

There are about 120 establishments in Japan at present engaged in this industry, several of the largest sending superb exhibits to the St. Louis Exposition, where they received several gold medals. The Japanese government exhibit also contained quite a pretty collection of ladies' hats, made up in light and elegant forms, some of which were trimmed with flowers, also made of chips in imitation of wild flowers of Japan.

The annual production of chip-braid amounts to 3,000,000 bundles, each bundle containing about fifteen yards, worth in Tokyo about 25 cents per bundle. The exports are largely to the United States and Great Britain, though the chip ribbons or shavings also go to Italy and France and to China.

A Final Decision in the Knibbs Valve Case.

Readers of the SCIENTIFIC AMERICAN will doubtless call to mind the occasional reference made in its columns to the famous Knibbs patent suit, which has been pending for twenty-five years. A decision was recently reached by the United States Circuit Court of Appeals, which probably disposes of the case finally. By the decision the city of New York is absolved from paying about $27,000,000 in damages and at least $60,000 in costs.

James Knibbs lived many years ago in Troy, N. Y. He claimed to have been the inventor of the relief valve which is now used on every fire-engine in the city of New York. A suit for infringement was begun in 1877 for the unauthorized use of the valve by the city. In a former suit the defense of laches was set up, it being contended that the inventor had not filed his invention for a patent within the statutory time. The patent was sustained, however, on a final hearing granted on November 9, 1881. The filing of a supplemental bill and a demurrer thereto opened the entire case once more, newly-discovered points being the reason assigned for this procedure.

Lawyer after lawyer has been employed in the case. Some have died while it was pending. The case of Jarndyce against Jarndyce, of which Dickens wrote so eloquently in "Bleak House," seems a model of swift legal procedure in comparison with this; and yet there are other patent cases on record which have been before the courts even for a longer time than this Knibbs relief valve litigation.

The Current Supplement.

The current SUPPLEMENT, No. 1513, opens with an article by our Berlin correspondent on a new offshore floating dock, which is remarkable in so far as it is provided with only one side wall. Prof. G. W. Ritchey's excellent treatise on the modern reflecting telescope and the making and testing of optical mirrors is continued. A third installment of Prof. N. Monroe Hopkins' splendid series of articles on electro-chemistry likewise finds a place in the current SUPPLEMENT. The subject discussed is the theory of electrolytic dissociation. The sortie of the Russian fleet from Port Arthur on August 10 is critically analyzed on the basis of descriptions furnished by officers of the battleship "Czarevitch." This is by far the most valuable account of a naval battle in the present war that has been published. The photographs show the exact nature of the damage sustained, and diagrams are published on which the hits are plotted. Commander Peary's remarks on the North Polar expedition are concluded.

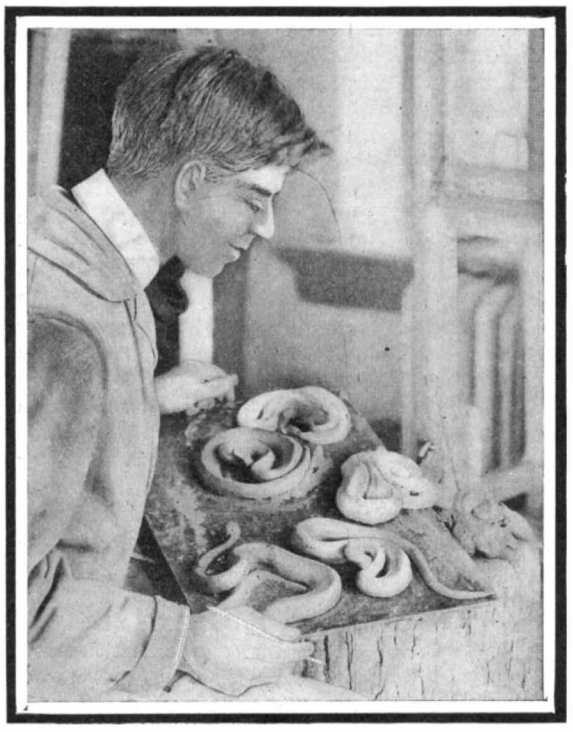
The black sands of the Quesnel River, in the Cariboo district of British Columbia, contain some platinum and osmiridium. These metals have not received much attention, owing to the difficulty of saving them.

THE MOUNTING OF REPTILES FOR MUSEUM EXHIBITION.

Representations of nearly every animal in existence—and some of creatures that have been extinct for thousands of years—never cease to attract the interest and excite the admiration of the visitor to the exhibitions. The exhibits are not always mere reproductions of the animal they represent. In our larger museums, and especially in the American Museum of Natural History in New York, the aim to a lesser or greater extent is to show the habits, environment, habitat, and mode of existence of the subjects. These details are carried out with such skill and are so true to life that they are really works of art. The reproduction of the vegetation, soil, rocks, water, etc., is often a remarkable achievement, and it has been only in the last decade or so that this art has been so highly developed.

We have become accustomed, from seeing the specimens which abound in the collections, to think of all such representations as stuffed, and we are quite sure that it is the taxidermist's business to stuff animals, as the derivation of the word itself would suggest. A glance into the studios and laboratories of the Department of Preparation, American Museum of Natural History, is sufficient to convince the most casual observer that some radical change has taken place in the field of taxidermy. It is no longer a stuffing of skins; it has become a plastic art employing the very methods and devices of the sculptor's studio. Instead of the chopped straw, excelsior, or the like which we look for, we find here boxes of clay, barrels of plaster, and the sculptor's armature of iron and lead framework, used to hold the heavy wet clay out of which he fashions his creations. The modern taxidermist has to be more than the term implies. He must be an artist, an anatomist, a naturalist, an artisan, a worker in clay, papier-maché, and plaster, and the success of his work depends to a great extent upon the skill with which he fulfills these various vocations.

The reproduction of reptilian life has always been a task of extreme difficulty. Slight defects that might be hidden under fur or feathers in another case are immediately apparent under the glistening, scaly covering of the snake or lizard. Besides, the peculiar nature of the skin—its toughness, rigidity, its lack of what the taxidermist calls "stretch," the tendency of the plates or scales to curl up and even fall out on drying—all formerly seemed to have combined with the antiquated methods of taxidermy to render any attempt to mount a snake a failure. So great have the difficulties seemed, that formerly most of these snake representations were mere plaster casts, made from the dead animal itself and colored in a manner as nearly true to life as possible. The results of this method are not very satisfactory, and to-day in the best work in reproducing reptile life the actual skin is used.



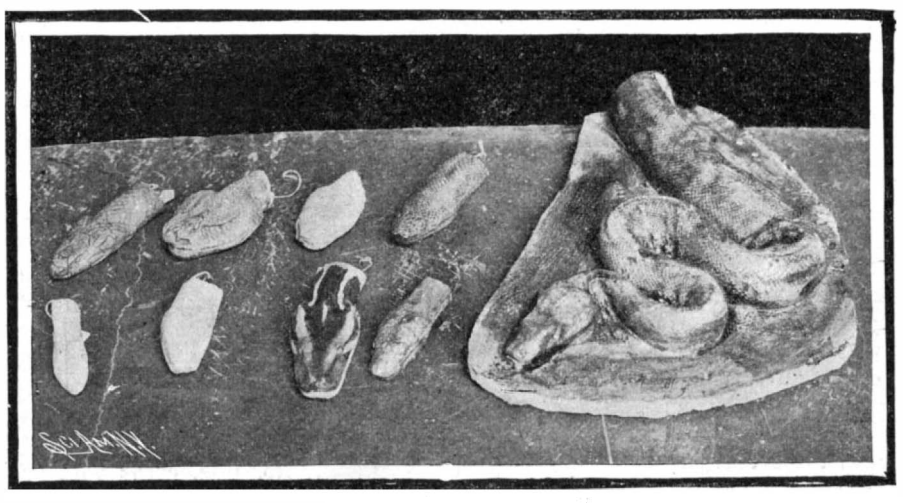
Making Sketch Models from Life.

The methods employed in the mounting of reptiles in the Department of Preparation at the American Museum are based on two very simple ideas, and in these two respects differ from the old methods. In the first place, the snake or reptile of whatever kind is modeled, and secondly the skin is never allowed to dry out. That these innovations in the manner of preparing the specimens are successful, needs no further proof than the groups on exhibition at the Museum.

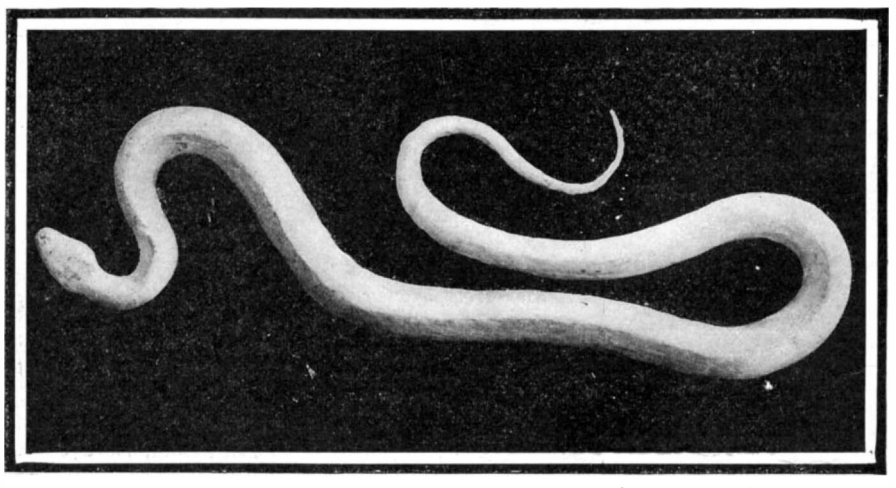
First the snake itself, if possible, or one of the same species, is usually carefully modeled in clay from life until, being studied with care, its postures, actions, curves, and the modeling of its form are mastered. The illustration shows Mr. Klein of the Department of Preparation making clay sketches of a number of copperheads. If a group is to be constructed, models of the group are made until one that satisfies the worker is obtained. The sketch models show the surroundings and groupings, and are often very artistic. Furthermore, for the purpose of study, the dead snake or snakes are now posed in various positions till several that are considered good are obtained, and plaster casts are made of separate parts that need especial attention, for instance, the head and neck. When a snake curves its body, wrinkles are sometimes formed on the inner side of the curve; and that the reproductions may be as nearly life-like as possible, casts of different curves are made, to allow the taxidermist to study them fully. This will give the layman some idea of the nicety of the work.

Drawing the Prepared Skin upon the "Manikin."

When a sufficient number of casts have been made, the skin is removed from the body and prepared for mounting. The preparation consists of a tanning process, for which either a weak solution of sulphuric acid and glycerine or for more delicate specimens a solution of tannic acid and glycerine is used. This latter, the glycerine being taken up by the moist skin, and after repeated applications nearly saturating it, has the property of keeping the skin moist to a slight extent and soft and pliable. It prevents the drying out and the incidental contraction and curling up of the smooth, scaly covering, to

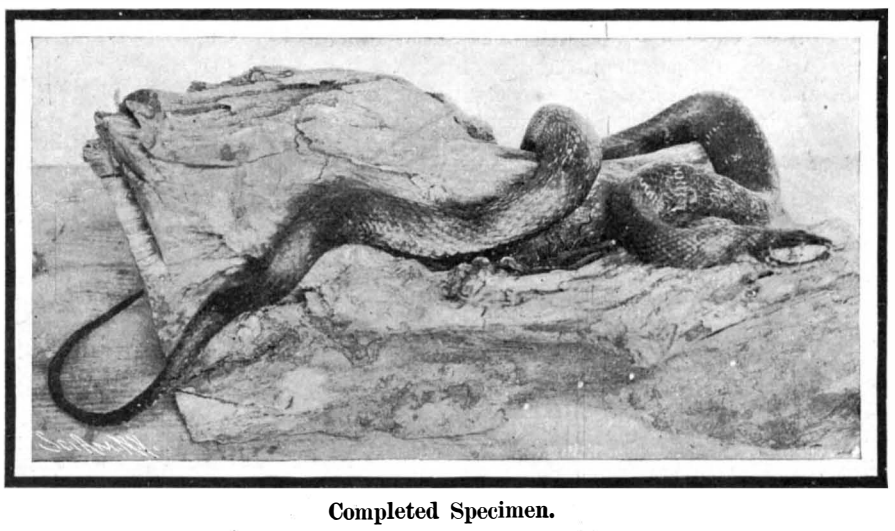


Plaster Casts for Study.



Finished "Manikin."

Removing the Skin from the Body of the Snake.



Completed Specimen.

THE MOUNTING OF REPTILES FOR MUSEUM EXHIBITION.

which so much of the peculiar fascinating beauty of the snake is due. The skin is now subjected to a process of shaving down, which leaves it quite thin.

The manikin upon which the skin is to be drawn and glued is begun. If the snake is a large one, the manikin may be built up upon a cast of the dead body of the snake posed in the desired position, or it is carefully modeled by hand to measurements taken from the specimen, plaster, papier-maché, and glue being used till the desired form is attained. The tanned skin is now tried on the manikin, and when the result is satisfactory is left on, the final touches being given after the skin is on, while the papier-maché is still soft, by pressing it into shape with the fingers.

Fig. 1.—Organistrum.

The glue in the papier-maché causes the skin to adhere, and the specimen is ready to be added to the group.

THE HOW AND WHY OF THE MODERN KEYBOARD.—II.

BY THE REV. F. W. GALPIN, M.A., F.L.S.

(*Continued from page 443, December 17.*)

In dealing with the keyboard as applied to stringed instruments, we have to retrace our steps, for although the manual of the organ and the keyboard of the pianoforte are now practically identical, their origin was quite different and distinct. The earliest form appears about the ninth century, attached, strange as it may seem, to an instrument played with the bow or its substitute. Old medieval manuscripts and architectural adornments show us the organistrum, of which an early example is given in Fig. 1, from a church in Normandy. The strings, no longer vibrated by the bow, are set in motion by a rosined wheel, the handle of which one of the performers is turning. His companion manipulates the keys, which consist of six little tongues of wood armed with a projecting spike or tangent which, when pressed on the string, "stops" it in the same way as the finger on the violin. This same instrument is known in the present day as the vielle or hurdy-gurdy. Many attempts have been made to perfect the application of keys to bowed instruments, and Fig. 3 represents one of these, called the claviola; but at present they are failures, the delicate movement of wrist and arm being unattainable. Now if the hurdy-gurdy key is forced sharply on the tightly-stretched string, a faint musical note is produced, merely by the percussion of the key tangent and without turning the vibrating wheel. We cannot but suppose that this effect was observed by the early musicians, and gave rise to the first form of true keyboard-stringed instruments, which we can recognize shortly after 1400 A. D. under the names "manicordium" and "clavicordium." The keys, unlike those of the first organ keyboards, were not hinged at the further end, but were "balanced" on a center pin, so that when the finger was placed on a key the other end rose, and being provided with a small tangent, something like those described above, struck the string stretched immediately above it. The clavichord continued in general use till the last century, and as a further proof of its primitive origin, it is interesting to remember that until about the year 1720 several of these little tangents acted on the same set of strings, sometimes as many as four of them, so that when the note of the fourth key was being sounded, it was impossible to obtain the notes of the first, second, and third keys. A good example of the mechanism of these so-called "fretted" clavichords is displayed in Fig. 2, the key shafts being cut at various angles to bring the tangents to bear on the required set of strings. Here too we see the "balanced key," and it seems most probable that this form was first used for the keyboards of the stringed instruments, and that toward the end of the fifteenth century, when the roller board was invented for the organ, as described in a previous article, it was applied to that instrument, also completely superseding the "hinged key" except in the smaller instruments.

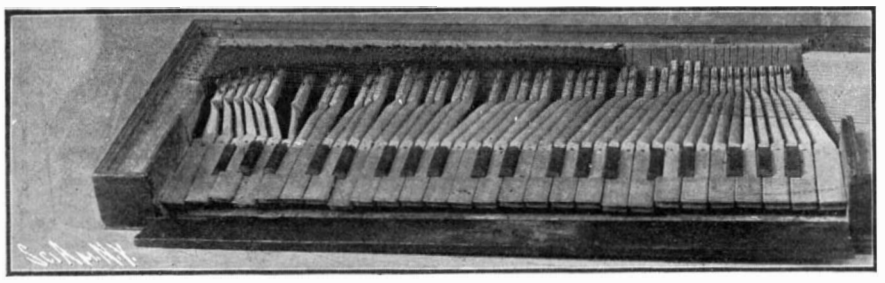


Fig. 2.—A Fretted Clavichord.

Side by side with the clavichord, though perhaps originally of later invention, we find in use throughout the middle ages a keyboard instrument derived from the ancient psaltery, and under its varying forms called the spinet, virginal, or harpsichord. In all these the mechanism is almost identical. The balanced key, instead of having a tangent fixed at the further end, has in its place a slip of wood called a "jack" working in a grooved register and furnished with a small quill or "spine," hence, some say, one of its earliest names. When the key is depressed, the jack is raised, the quill plucks the string stretched above and sets it in vibration in the same way as the "plectrum" of the mandolin. As the quill is attached to a little movable tongue, when it returns on the finger being removed, it repasses the string without causing it to sound. In Fig. 4 the little "jacks" will be noticed under the railboard, which keeps them from jumping out of the instrument at the touch of too vigorous a player. In England this oblong form of the spinet was often called the virginal, being extremely popular with young ladies; in the sixteenth century, as shown in the illustration, the actual instrument could be removed from its decorated case. Fig. 10 represents a spinet of the same century, with a curious arrangement of the tuning pins immediately over the keys (*spinetta traversa*). Double virginals are sometimes found, and a very rare and valuable specimen is depicted in Fig. 9. The two instruments are quite distinct, the smaller one, tuned an octave higher, being removed and placed on a table for performance. The harpsichord, called also the clavicembalo, was always made in wing shape like the modern grand piano. Fig. 5 is an illustration of a seventeenth century instrument with one keyboard, while Fig. 8 shows the two-manual harpsichord. Mrs. Brown's collection is fortunate in possessing a three-manual instrument. The various keyboards had separate "jacks," and acted on different or additional sets of strings. Upright harpsichords were also constructed, as in the highly ornamental specimen shown in Fig. 7. The reader may have noticed in the illustations of the keyboards given in these two short articles, that in the older instruments on the extreme left of the keyboard there appears to be an odd natural. The reason of this is as

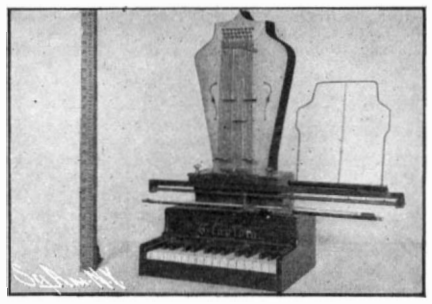


Fig. 3.—Claviola.

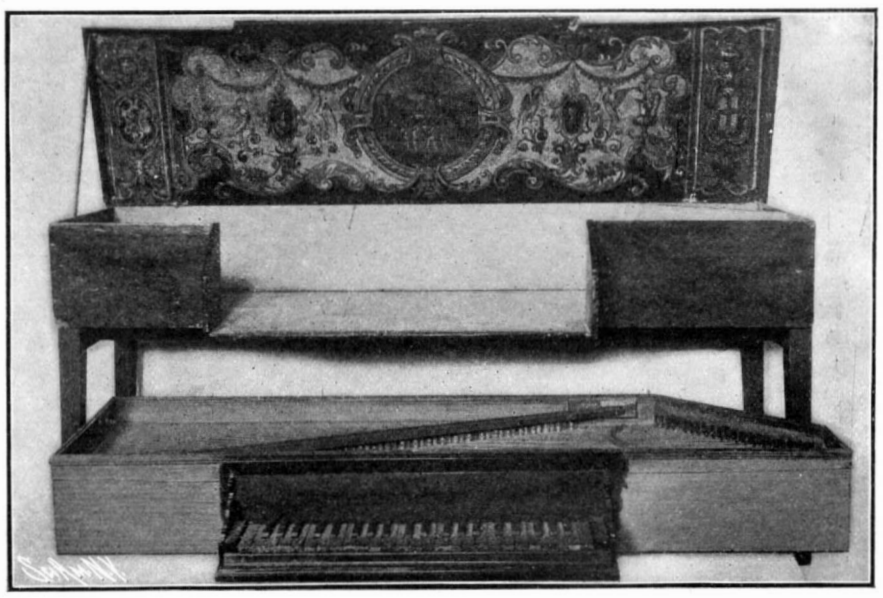


Fig. 4.—Virginal and Case (XVI. Century).

Fig. 5.—Harpsichord (XVII. Century).

Fig. 6.—Cristofori Pianoforte.

THE DEVELOPMENT OF THE MODERN PIANO.

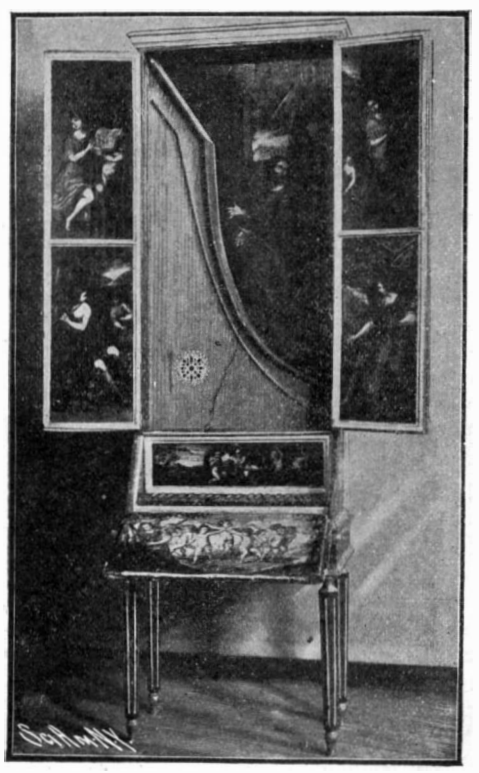


Fig. 7.—An Upright Harpsichord.

follows: The lowest note of the earliest organs was B-natural, following the structure of ancient models, but a more popular use was discovered for this odd note; for, as the old music required only the scales with few sharps or flats, it was found that, at any rate in the bass, the keys for D-sharp or C-sharp could be dispensed with, and that by using these keys for B-natural and A-natural, with the odd natural for G, the compass of the instrument could be extended by a fourth. This is so in the double virginal (Fig. 9), while in Figs. 2, 4, and 10 the lowest G-sharp and F-sharp are altered to E-natural and D-natural, the odd key at the end being not E but C. This arrangement, known as the "short octave," did not cause much inconvenience so long as musical composition remained in this simple state; but when other scales were employed freely, it was found necessary to replace the old G-sharp or F-sharp keys in the bass. Hence arose those curious "cut sharps," often erroneously called quarter notes. The key being cut in two crosswise, the lower half of each note gave E-natural and D-natural, and the upper G-sharp and F-sharp. But so seldom were these lower accidentals used, even at the close of the eighteenth century, that, in organs especially, the lowest C-sharp was often omitted. In the earliest known pianoforte keyboard (Fig. 6) this, as will be seen, is not so. The keyboard then, as now, stands in its true proportion, though it has been extended from the four octaves of the sixteenth century to the seven octaves and over of our own day. That it is imperfect cannot be denied, for there are many more than thirteen appreciable sounds within the octave, and at the best it can only be a makeshift. But if any of our readers have tried to master the wonderful "Janko" keyboard, or studied the elaborate proposals of even seventeenth century theorists, they will be thankful that the keyboard remains as it is. *Ars longa, vita brevis.* And considering how short life is, it is fortunate for us that the art of practical music, intricate at its best, is not entirely removed from the range of human possibilities.

The accompanying illustrations are reproductions of photographs of instruments in the admirable collection donated by Mrs. John Crosby Brown to the Metropolitan Museum of Art in New York.

Slaby's New Indicator for Wireless Telegraphy.

Among the numerous instruments which are used for indicating electric oscillations one class may be distinguished by its great sensitiveness. To this belong, for example, the coherer, the microphone in combination with a telephone, and the magnetic detector. These are suited for the reception of very weak electric indications, and for that reason are used at receiving-stations for wireless telegraphy. Another group, consisting of hot-wire ammeters, air-thermometers, sparking gaps, and the like, permits of quantitative measurement of the potential and current strength, but is far inferior to the first in sensibility and is therefore only used at transmitting-stations.

Prof. Slaby has recently patented an indicator of electric oscillations of medium sensibility, the employment of which is very convenient and the manufacture of which, by reason of its simplicity, is remarkably cheap. The phenomenon which led to this new invention is as follows: When a strip of so-called "gild paper" was laid under the terminals of a resonator-coil, long lightning-like sparks of greenish color were produced which were also visible in daylight. A simple closed oscillating circuit served as wave-producer. The effect due to the phenomenon was materially strengthened when small sheets covered with barium platino-cyanid crystals were brought under the terminals of the resonator-coil, and the maximum radiation resulted when gold-leaf was rubbed on the fluorescent sheet.

It has not hitherto been possible to explain or determine the phenomenon with any certainty from a physical standpoint.

In carrying out his idea, Prof. Slaby employs an insulated copper wire of comparatively thin cross-section, wound in a close spiral on a glass tube of about 0.75 inch diameter. The lower end of the copper wire preferably is conductively connected with a metal handle, which handle is formed by a metal tube drawn over the glass tube. The upper end of the copper wire is connected with a fluorescent sheet, formed of a small sheet of paper which is coated on one side with barium platino-cyanid crystals. Metal in a fine state of division is then applied to the rough crystal surface. This is accomplished by rubbing gold-leaf on the crystal-coated surface. Instead of the barium platino-cyanid any other fluorescent substance can be used. Also instead of gold other metals can be employed. Precious metals which are not subject to oxidation are used for the purpose. The fluorescent sheet made in this way is inserted at the upper end of the glass tube, which is not wound with copper wire, and is by means of a stopper pressed from inwardly against the glass wall.

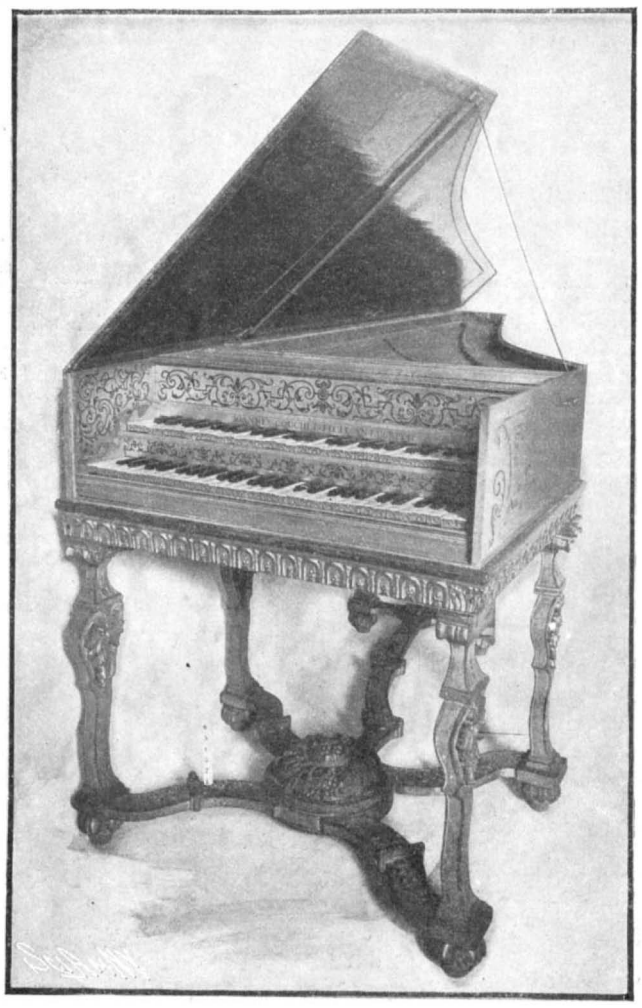


Fig. 8.—Harpsichord (XVII. Century).

Supposing the copper-wire coil is in resonance with a neighboring vibration system and oscillates in a wave of one-quarter the length of that of the primary system, while the end of the coil earthed by the hand of the person holding the rod forms the potential node, the upper end connected with the fluorescent sheet forms the point of greatest variation of potential, the fluorescent body becomes powerfully illuminated and easily visible in full daylight. In order to be able to use the indicator for determining the wave length or periods in an oscillating system in a practical and simple way and make the earthing of the coil independent of the body of the person holding the rod, a tuning-rod of metal is provided, which is connected by a conductor with a plate, preferably of lead, serving for earthing the rod. In using the apparatus the plate is laid on the ground, this fully sufficing for the establishment of a good earth connection of the rod, and then the rod is moved along the coil until the fluorescent body is brightly illuminated. A scale arranged on the coil allows the wave length or period at which resonance commences to be seen. It is understood therefrom that the adjoining oscillating system from which the excitation proceeds oscillates in correspondence or with equal wave length. The scale can be united in various ways with the rod. It is preferable to indicate it with suitable colors on the wire winding itself. The excitation of the coil by the system to be tested can take place in various ways. If the coil is brought very near to the vibration system, especially to the coils thereof, the excitation of the indicator-coil would take place by means of electromagnetic radiation, while in cases where the indicator-coil is held further removed from the oscillating system an electrostatic transfer would take place principally through the earth.

In general, in all transfers inductive coupling between the secondary coil and the system to be tested is shown to be essential, while direct coupling, for example, by the conductive junction of the secondary coil and the system is not advisable, and considerable errors of ten to twenty per cent result therefrom.

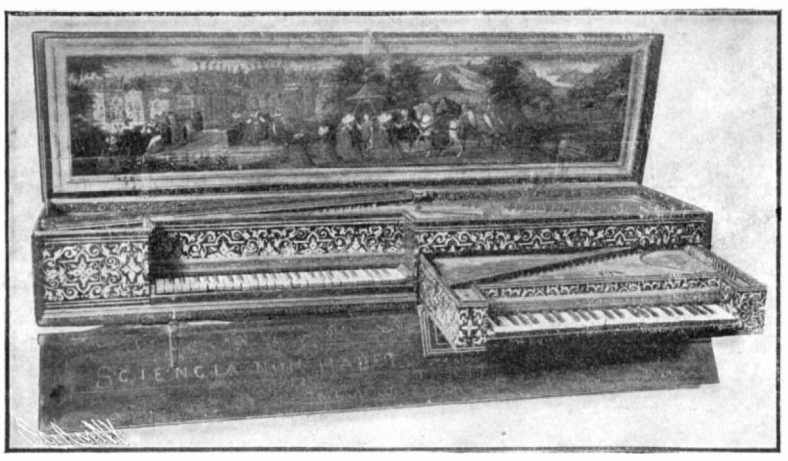


Fig. 9.—A Rare Double Virginal.

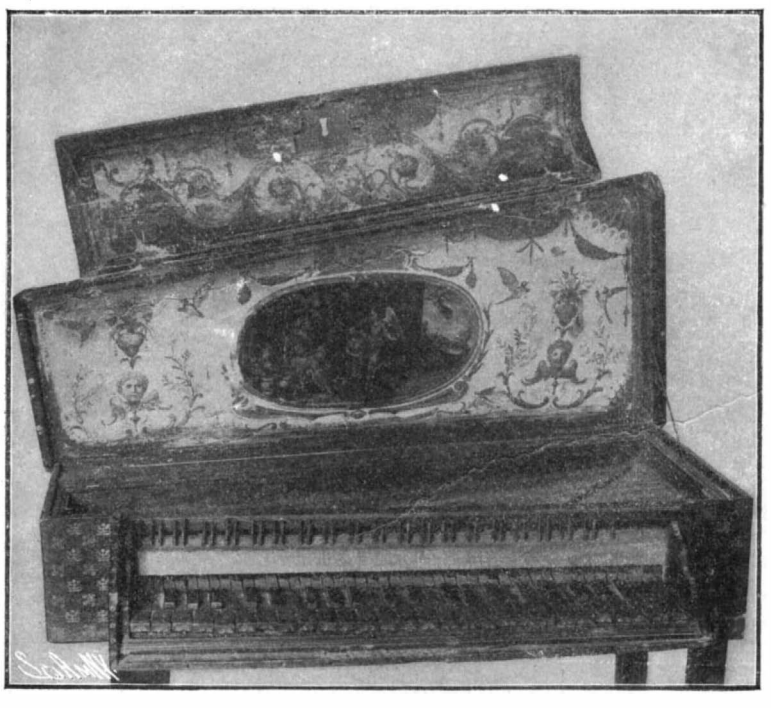


Fig. 10.—Spinet (XVI. Century).

THE DEVELOPMENT OF THE MODERN PIANO.

Action of Radium Upon the Organism.

Dr. Jules Rehns contributes to our knowledge of the action of radium upon the organism in a memoir presented to the Société de Biologie of Paris. He made the experiments with 10 milligrammes of pure radium bromide obtained from M. Giesel. The salt was contained in a small trough of ebonite which had a mica cover, so as to intercept the α-rays and allow the β and γ to pass. On the healthy skin a direct application of the rays for 1 minute produces a slight red spot after 48 hours. This disappears in 12 days, leaving a light brown pigmentation. A 5-minute application to the back of the hand provokes a reddish spot at the end of 12 hours, which turns to a dark red in two or three weeks, with a raised surface. This becomes brown and then shrivels up, leaving a white scar. Repeating the action in the same place brings about the same result and the second scar resembles the former. The effect differs according to the region of the skin. On the palm of the hand at the points where the skin is the thickest, he did not obtain a scar, but only a slight peeling of the skin. On the eyelid it produces a swelling of the skin. The eye itself does not suffer at all, according to him, even upon an hour's application, during which he sees the fluorescence produced by the radio-activity of the different media of the eye. The author made the experiments upon himself, but states that the results are likely to change greatly according to the individual. Thus in one case when placed upon the pharynx of another person, it gave rise to painful burns. Radium is not to be used indiscriminately by physicians, and its improper use might cause grave consequences. As to the so-called anæsthetic properties of radium he fails to find any such action by applying it to the extremities of nerves or along their path. In the case of the frog, sensitiveness to pain is not diminished by applying it on the skin or the main nerves.

Phosphate rock is of organic origin, largely derived from guano and decaying animal matter which contains phosphoric acid. In rainless regions such as the Peruvian coast and some of the Pacific islands, the guano may accumulate to great thickness without loss of soluble matter. In moist districts, however, the phosphoric constituents are dissolved out by percolating waters, and the solutions coming in contact with limestone may convert the latter into lime phosphate. The phosphate deposits of Florida are thought to have been formed in this manner.

NISSEN AND HIS "FOOL-KILLER NO. 3."

BY ORRIN E. DUNLAP.

It may take time and the efforts of others to demonstrate whether or no Peter Nissen has left anything of scientific value in the ideas he entertained of traveling over land or water in a balloon-shaped apparatus such as that in which he lost his life in an attempt to cross Lake Michigan on Tuesday, November 29 last. Despite his failure to survive the journey, it is evident that an apparatus such as he designed will roll with the wind over land, water, or ice, but it is too early in the history of the device to determine in what field it might prove serviceable or useful. Man has already devised and constructed so many things in which one may travel, that this infant of Nissen's has not yet found its place.

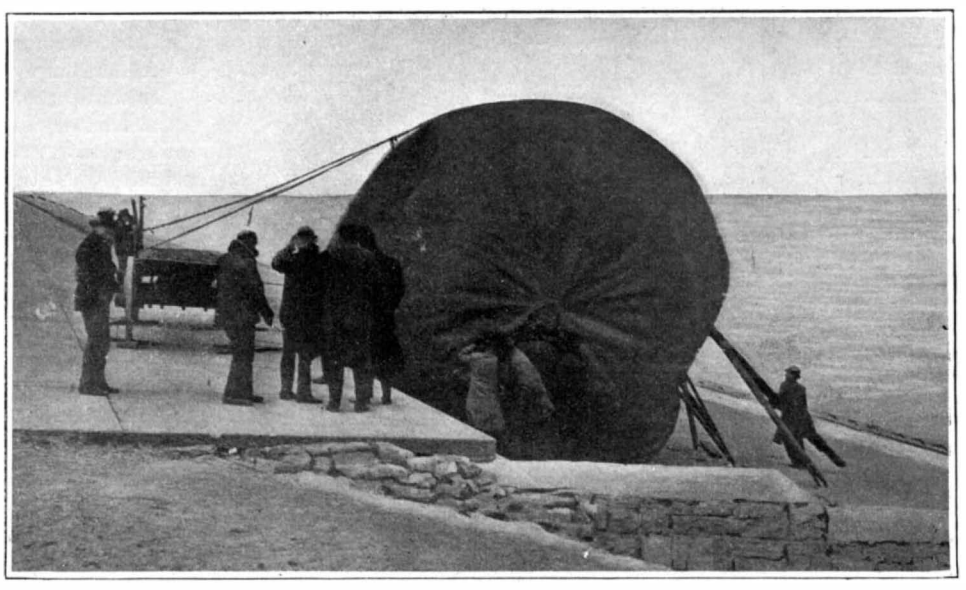
Considering that this adventure of Nissen's was the first of the kind man has ventured to make, it is to be regretted that he lost his life in the feat. It is reasonable to believe that he made the trip across Lake Michigan successfully, and that had aid been rendered him promptly on the Michigan shore, he would have lived to relate his experience. Even had the feat been performed at a season of the year when the weather conditions were more favorable for exposure, or more boats traveling up and down the lake, Nissen would in all likelihood be alive to-day. Recalling the stories told of sea serpents, it must be left to the imagination to conceive the story that a lake captain might have told had he been a witness of Nissen's strange craft rolling across the bow of his boat.

Peter Nissen believed his balloon-like apparatus had a value in connection with North Pole explorations. His first experiment with a rolling balloon pleased him. This first balloon was five feet long and three feet high. It had a shaft through its center, and on this he placed a car spring. He used a car spring because it was handy and convenient, and he felt it would slide from end to end, much the same as a man might move about. His experiments delighted him, and he decided to build the larger balloon, in the operation of which he lost his life.

This balloon was made of heavy canvas, and when inflated was 38 feet long and 22 feet in diameter. It had a porthole at each end, and through the center was a shaft about 12 feet long and 3 inches in diameter. This shaft was suspended from cords fastened around the inside, on exactly the same principle as the spokes in a wheel. On the shaft he arranged a sliding seat, so that he could move toward the ends, hoping in this way to steer the big ball by throwing one end up in the wind to cause it to swerve as he desired, as the high end would offer more surface to the wind. Suspended from the shaft and below the seat was a cradle or a boat, where he contemplated resting when fatigued from riding on the seat. A two-inch hose was run through one end of the balloon to furnish an air supply, a pump of his own invention being on the inside. "Fool-Killer No. 3" is the name he selected, he having previously built two boats for navigating the whirlpool rapids of Niagara, the first having been named "Fool-Killer No. 1," which was rebuilt and renamed "Fool-Killer No. 2." This latter boat was deserted and lost in the Niagara whirlpool on the evening of Thursday, October 17, 1901, after Nissen and a companion had floated helplessly about those rough waters for seven hours.

It was 3:10 P. M. November 29 when Nissen called from the inside of his balloon to set her free. Thirty-five minutes later the balloon had passed from sight of those at the foot of Ohio Street, Chicago, from which point the start was made. Late in the morning of the Thursday following Mrs. Sophie Koehler, the wife of a farmer living near Stevensville, Mich., found Nissen's body on the lake shore, and 200 feet away was "Fool-Killer No. 3," torn and wrecked. The coroner's jury decided that Nissen died from exposure, the supposition being that he had made an effort to reach shore, but was too much exhausted. He left no message, all reports to the contrary notwithstanding. As to his experience on the trip and when he died, there is nothing certain; but as the air hose was broken, it aroused suspicion that his supply of fresh air was cut off at some point on the journey across Lake Michigan to eternity.

The "Fool-Killer" Starting on Its Fateful Journey Across Lake Michigan.



Rolling the "Fool-Killer" Into the Lake.

NISSEN AND HIS "FOOL-KILLER."

Radium and Other Rare Elements in Mineral Water.

BY OTTO MEYER, PH.D.

In an analysis of a water from an artesian well, bored several hundred feet into the granite of Richmond, Va., called "granite lithia water," there were reported by me some ingredients which, it seems, have not been previously detected in mineral waters. They were cerium, lanthanum, didymium, beryllium (glucinum), bismuth, and also radium. While radio-active gases are known to exist in many waters, the supposition heretofore has been that radium, as such, was not in these waters. It is therefore considered necessary to give an account of the methods used in this analysis.

It was found that the barium of the granite lithia water, isolated in the usual way as $BaSO_4$, was slightly but unmistakably radio-active. This in itself can hardly be explained otherwise than by the existence of radium in it. It was deemed advisable, however, to look for all the additional proof that might be obtained in this case. Therefore 52 milligrammes of barium sulphate were obtained out of 550 liters of water, evaporated in 50-liter lots in china basins. This sulphate was transformed into carbonate, which again, by treatment with HBr, was converted into barium bromide. This was subjected to a series of fractional crystallizations from solutions in water, acidified by hydrobromic acid. Finally, there were 5 milligrammes of a quicker crystallizing and 31 milligrammes of a slower crystallizing barium bromide on hand. By an accident 4 milligrammes of the former substance were lost. The remaining 1 milligramme, wrapped in paper, was placed on a photographic plate, side by side with 1 milligramme of the second substance. After development it was found that the spot caused by the first substance was considerably stronger than the one caused by the second substance. The barium bromide, therefore, had become richer in radio-active substance by the fractional crystallization. We have then here the principal, if not the only, chemical characteristic of radium.

In examining for radio-activity, the photographic method was used. The substances, either in glass tubes or wrapped in paper, were placed on a plate, which had been wrapped in heavy black paper and was kept carefully in the dark. Some experience in developing is necessary in these experiments, where only small and often faint spots are obtained.

It is of the greatest importance to keep in view that freshly-ignited radium loses its power of emitting β and γ rays, which alone act on the plate. Within a month, however, the radium emanation is restored to nearly its original strength, and four weeks after a barium salt has been made, a test may be made.

The cerium group and glucinum were obtained in the precipitate by ammonia, which in a water analysis furnishes the iron and alumina. This precipitate was twice redissolved and reprecipitated. All the filtrates and wash waters together in a very large beaker were left standing for one or several weeks, when the precipitate formed again and settled during this time, was combined with the previous precipitate. The whole was dissolved in HCl, nearly neutralized, an excess of ammonium carbonate (solid) added, after standing a day or more, filtered, and the filtrate boiled, when the cerium group (or most of it) and glucina are reprecipitated. The filtered precipitate was dissolved in HCl, and the cerium group precipitated in slightly acid solution by ammonium oxalate. After one or several days' standing the earths were filtered and ignited. What remained insoluble in HCl, and HCl and alcohol, was considered as ceria. In another lot the separation with chromic acid was resorted to, and lanthanum and didymium separated in form of fused nitrates by water. No attempt was made here, where we have to deal with faint traces only, to go beyond didymium and establish neodymium and praseodymium.

The glucina was separated from iron and alumina, which eventually passed through previous treatments. by the method described in Crookes' "Select Methods," p. 125, as basic acetates, ammonium acetate being used instead of sodium acetate. The glucina obtained in this way was further examined by boiling the freshly-precipitated hydrate with ammonium chloride, which dissolved it, so that it could be reprecipitated.

The quantitative determination was attempted, in all cases, but "traces" were reported in each instance, as the quantities are extremely small. It is of no use to test less than 100-liter lots. The substances were obtained in three successive lots.

Bismuth was obtained only in two successive lots of 100 liters and 50 liters, finally as chromate, which is better adapted for qualitative than for quantitative examination. As the quantities, however, agreed exactly, it was reported quantitatively, instead of "trace."

In the course of the analysis of the water substances were met which possibly might be traces of other rare elements, and among these might be thoria, zirconia, and platinum. No time, however, could be given to a more thorough investigation, whether they really existed or not. Platinum, if it was such, was isolated from the sulphureted hydrogen precipitate of a 100-liter lot, after the other metals had been removed, as minute black flakes, which, according to previous treatment, might be platinum or iridium. Cupeled with test lead they gave a minute non-yellow button, under supposition of existing platinum, of lead-platinum, too small for any examination. As platinum occurs disseminated in certain rocks in North Carolina, it may be well to mention the matter for the consideration of future analytical work.

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The greatest accumulation of coin in the world at present is that held by the Bank of France. At the beginning of August this amounted, in round figures, to 2,702,292,000 francs in gold, and 1,125,920,000 francs in silver; a total of 3,828,212,000 francs, or $765,642,400 in United States currency.

THE EGYPTIAN PAPYRUS, PAST AND PRESENT.

BY GUY E. MITCHELL.

The papyrus plants of ancient Egypt are not all dead, though papyrus paper making is a long-lost art. As a beautiful ornamental plant the papyrus thrives to-day, and is perhaps destined to become a favorite along the banks of our warmer streams and rivers. In Florida or Louisiana in a noiseless electric launch the visitor may then glide up creeks and winding rivers, and drift back some thousand years into the dim and hazy days when the Pharaohs and the Ptolemies and Cleopatra ruled the land of earliest civilization.

In the days of paper-making Egypt, the banks of the Nile near the sea must have been covered with great stretches of this wonderful plant. The bass-reliefs on Egyptian monuments show the methods of this culture, while the great Alexandrian library with its half million long papyrus rolls, burned by the ruthless Mohammedans, gives an idea of the extent of its use. Alexandria was the center of its manufacture, and throughout the Nile delta were large plantations of this graceful and lordly plant.

As late as the eighteenth century travelers in Egypt found the fellaheen or peasants making mats of papyrus, although the art of paper making has been long dead. To-day you may search lower Egypt in vain for a single plume of papyrus, although on the upper reaches of the Nile you can still lose yourself in its dense forests, which everywhere line the banks of the sluggish river. The few plants now growing in the Ezlee Kieya garden in Cairo are said to have been imported there from Hamburg.

It seems strange that a plant which once played such a rôle in the world of literature and history should have become so neglected that probably not one in ten thousand of the people of the United States could tell what it is like or would know it if they saw it, except that they would recognize a plant surpassingly beautiful.

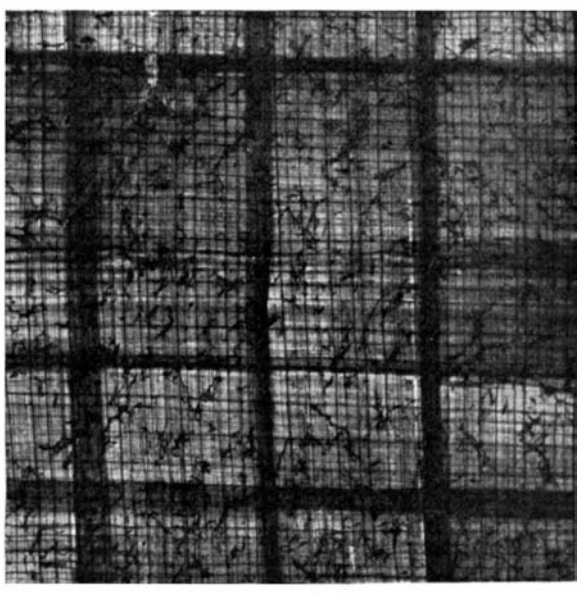
The papyrus of old Egypt would add an irresistible charm to our southern waterways. To enthusiasts on beautiful plant forms it were well worth a visit to Sicily just for a look at the miles of papyrus which overhang the Anapo River, as well as its source, a deep clear spring just outside the ancient city of Syracuse. It is difficult to conceive a more brilliant or more fairy-like sight than the thousands of smooth, slender, leafless stems, rising in graceful curves from the water to a height of fifteen feet and bearing at their summits feather-duster tassels of delicate green filaments. As the boat winds in and out among this multitude of smooth stems, or as you separate the tassels which nearly touch overhead, it is easy to believe yourself in a tropical forest, where all the tree trunks are brilliant green and all the leaves are threads of but a lighter vivid hue. This wealth of papyrus on the Anapo is one of the most fascinating sights in the world, and every year thousands of visitors make the excursion from Syracuse to view it.

If the experiments which are being started with the papyrus by the Office of Plant Introduction of the Department of Agriculture are as successful as Mr. Fairchild, the agricultural scientist in charge of the office, hopes, that plant may yet become a favorite ornament in Florida, where many streams like the Anapo are to be found, and where thousands of visitors repair annually to look upon and enjoy strange plants and fruits and to thaw the cold and frost from the marrow of their bones.

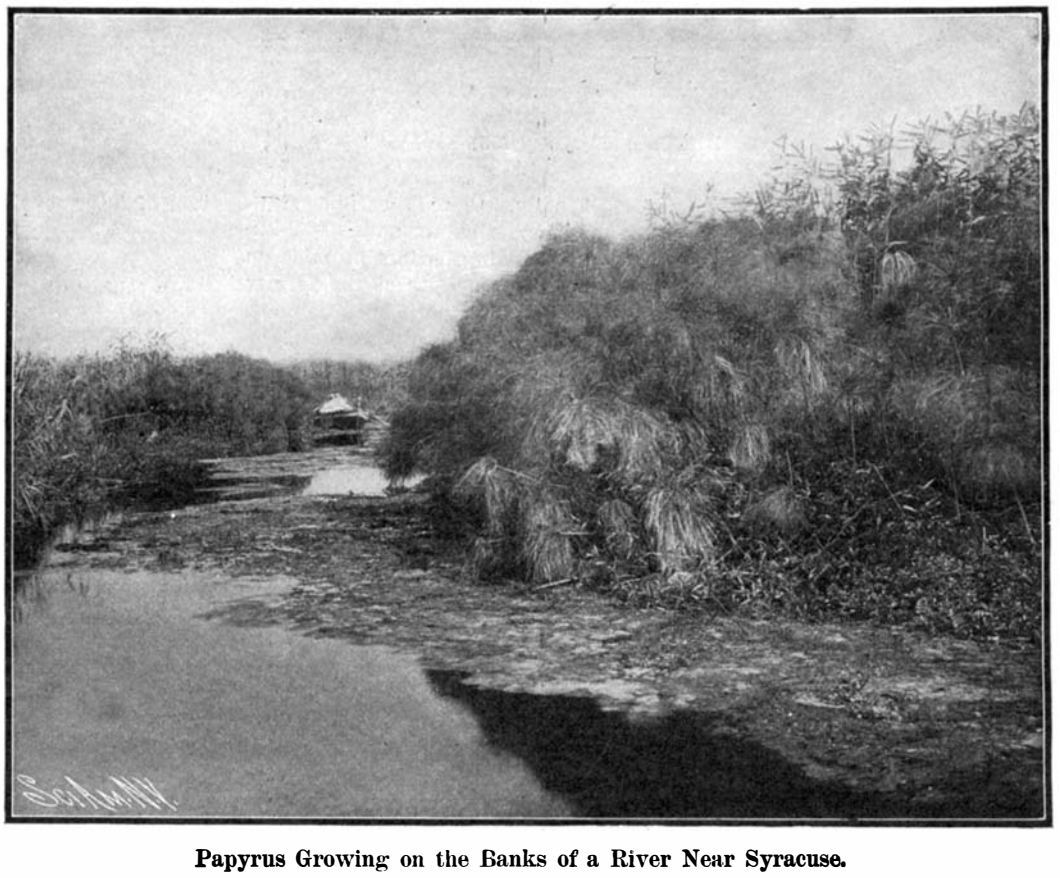
Recent excavations at Abusir have brought home the universal importance of papyrus in illuminating many a dark spot in ancient history and literature. In one of the graves at Abusir was discovered, on February 1, 1902, a papyrus roll containing a large portion of the poem Persai of Timotheus. The papyrus was found in a wooden coffin still containing its corpse, together with a pair of sandals, a broken leather bag, a piece of rust-eaten iron, and a fragment of burned wood. All these objects are now at the Royal Museum of Berlin, and the papyrus has been published with a transcription, paraphrase, comments, and a facsimile reproduction in heliogravure, by Prof. Dr. Ulrich von Wilamowitz-Moellendorff. The papyrus measures 18.5 centimeters in height and when unrolled has a length of 1.11 meters. It is inscribed with six columns of varied width and unequal number of lines in archaic Greek characters, resembling the style of monumental inscriptions, so that in the opinion of

Timotheus Papyrus, Column VI.

Prof. Wilamowitz this papyrus represents the oldest book known, antedating the founding of the library of Alexandria and the establishing of the Alexandrian book trade. The last four columns are on the whole well preserved, while the first column, not protected by covering, is crumbled into minute fragments and of the second column the lower half is for the most part destroyed. A narrow margin on the first column, showing traces of having been cut through, proves that only part of the scroll had been deposited in the grave. We have, therefore, in this papyrus only the latter portion of the work. The fact, however, that Timotheus names himself as its author and that it treats of the naval defeat of a Persian king suffices to establish its identity with the Persai of Timotheus, which celebrates the naval victory of the Greeks over Xerxes, the King of Persia, in 480 B. C. at Salamis, which was one of the decisive battles in the Græco-Persian wars. Timotheus was a celebrated poet and musician who was born at Miletus, Asia Minor, and died at an advanced age about 357 B. C. He was especially distinguished as a composer of the so-called "nome," an ancient song or ode in the epic style, consisting of a narrative interwoven with speeches of introduced characters, and sung to the accompaniment of the lyre by the poet himself on festival occasions in honor of some god. He is also recorded to have increased the number of the strings of the lyre to eleven, by which innovation he incurred the displeasure of the Spartans, who considered it to be a corruption of music. But of the numerous compositions credited to him by later writers only a few fragments survive, and of the Persai only three verses were known. The Persai is also in the form of a nome and was first recited at the Panionion festival in honor of Poseidon, about 398 B. C. The part of the nome contained in this papyrus begins with the principal section of the poem, the omphalos, comprising the narrative. The ships are fitted out; the battle begins; the vessels dash against each other; lances fly about; firebrands whirr in the air, setting the ships afire, from the glare of which the "smaraged" sea is reddened. The Persian fleet is put to flight; one rich follower of the Persian king battles with the waves, cursing the treacherous sea, and at last sinks while professing his hope for the victory of his king. Other Asiatics cling to rocks in the sea and bewail their imminent fate of death or captivity. At last panic seizes also the royal headquarters, and the king, under lamentations, orders a general retreat of his motley army. The victorious Greeks erect a trophy to Zeus and celebrate their victory with dance and song. In the epilogue the poet refers to himself, defending his innovation in music against the reproof of the Spartans, and invokes Apollo to "give the people peace and blessing resting on the observation of the law."



What Papyrus Looks Like when Held Up to the Light.



Papyrus Growing on the Banks of a River Near Syracuse.

THE EGYPTIAN PAPYRUS, PAST AND PRESENT.

The German Naval Estimates for 1905.

According to the recently published estimates for the German navy for 1905, several important additions are contemplated. Hitherto Germany has regarded the submarine vessel as being still in an experimental stage, but owing to the progress of development of this craft by other powers, a sum of $375,000 is to be devoted to the purposes of carrying out experiments with a view to finding the most suitable type of submarine boat for use in the German navy. Special attention is to be devoted to artillery armaments, upon which $7,317,750 is to be expended. This represents an increase of $1,686,250. Owing to the employment of stronger armor plating for ships and the increased range of the guns of the navies of the other maritime nations, the power of the biggest and medium-sized weapons is to be considerably augmented. There is to be an appreciable increase in the quantity of ammunition carried by the battleships and armored cruisers. Furthermore, the lighter guns designed fundamentally for repelling torpedo-boat attacks are to be considerably increased in their power, to render them better fitted for this work. At the same time a corresponding augmentation of the armaments of the torpedo boats is to be carried out, and a new and more serviceable type of torpedo boat is to be designed for the Imperial navy.

Experiments have been carried out by the fire brigade authorities of Manchester, Eng., with a new type of helmet. It is especially designed to facilitate the penetration of dense masses of smoke. The helmet is equipped with incandescent electric lamps, while an air current is directed upon the eyes and nostrils to protect them from smoke. The equipment is completed with a telephone apparatus, so that the fireman when he enters a building can always maintain communication with the force outside, and if necessary summon assistance.

RECENTLY PATENTED INVENTIONS.

Of General Interest.

PUMP.—P. J. LEITHAUSER, Clarendon, Texas. This invention relates particularly to improvements in pumps for raising water from deep wells, an object being to provide a pump with novel means for centering and yieldingly holding the pump at any desired position in a well-casing and also to provide a simple means whereby the working parts of the pump may be readily raised from the well when it is necessary to make repairs.

SEAT-BRACE.—C. B. LIMERICK, Mount Sylvan, Texas. The invention is an improvement in braces for spring-boards, such as spring-seats on wagons and the like. The brace prevents the seat from careening in either direction, will avoid breaking the bolts which secure the springs to the seat, will take up lost motion, and will render the seat safe and secure.

COMBINATION PENCIL-SHARPENER AND ERASER.—C. PAYNE, Los Angeles, Cal. This combination instrument is formed from a single piece of metal and may easily be cut out and shaped up by machinery, and thus very cheaply manufactured. There are no springs, screws, or separate knives in Mr. Payne's invention, which is an advantage in the durability of the article and in the saving of the original expense.

CHAIR.—C. E. WHIPPLE, North Charleston, N. H. The invention refers to improvements in camp chairs or stools, an object being to provide a chair so constructed that the seat may be readily raised or lowered as occasion may require and the back of which may be arranged straight or at any desired angle or inclination by the person while sitting in the chair.

ARTIFICIAL LIMB.—S. J. HENRY, Princeton, Iowa. In this patent the invention has reference to artificial limbs. The object of the improvement is the production of an artificial limb which may be worn with comfort and which in use gives a certain elasticity of movement, preventing shocks and jars to the amputated limb.

SPRING-SUPPORTED SIDEWALK.—J. S. GREGG, Pomona, Mich. The invention has for its purpose the provision of novel details of construction for a sidewalk to be used by pedestrians which render the sidewalk measurably resilient and adapt it for service at any point where it is desired to locate a sidewalk, the resilience of the structure rendering it easy to walk upon.

TRESTLE.—L. O. CLAYBAUGH, Toulon, Ill. The principal object in this case is to provide a device of simple and durable construction which may be quickly and readily adjusted to different heights, which may be considerably extended in length when necessary, and which may be folded into a very compact form for convenience in transportation.

COMBINED LETTER-OPENER, PENCIL-SHARPENER, AND ERASER.—A. F. REBHAN, Syracuse, N. Y. Mr. Rebhan's improvement relates to a combined letter-opener, pencil-sharpener, and eraser; and the object of the inventor is to provide a small, compact, serviceable, and inexpensive implement of the character specified which may be conveniently carried about and which may be easily manipulated.

DECOY-DUCK.—G. W. GREEN, Lincoln, Neb. The intention in this instance is the provision of a decoy which shall be light and easily taken apart for shipping and carrying about, thereby preventing the breaking of the parts. To these ends the invention consists of a duck the body portion of which is hollow, made of wood or fiber, and the head portion being of metal, made hollow and readily attached to and detached from the body portion.

Hardware.

WRENCH.—P. F. DUROSS, New York, N. Y. The purpose of the inventor is to provide a wrench which is primarily a pipe-wrench, the said wrench being so constructed that it may be quickly and conveniently adjusted to take various sizes of nuts or different sizes of pipes and so that it will act with a maximum of power on the article gripped, but without a tendency to unduly mutilate or mar the article

COMBINATION-TOOL.—A. P. BERGGREEN, Elkhorn, Iowa. This tool embodies in its construction a carpenter's pincers or pliers, a nail-puller, and a plurality of wrenches. An object of the invention is to provide an implement extremely simple in its construction, the arms and jaws forming the body portion thereof being connected in such a manner that they may be easily separated and each one of the members may be used as a wrench.

Heating and Lighting.

HOT-WATER HEATING APPARATUS.—A. B. RECK, Copenhagen, Denmark. This invention relates to apparatus of that class in which steam is introduced directly into the water to be heated. The subject-matter of this application is a division of a prior application filed by Mr. Reck. The object of the invention is the construction of an apparatus in which a very economical operation and exact regulation can be obtained by the same low steam-pressure that is now used in common house-heating steam boilers.

FURNACE-GRATE.—R. M. RUBIO, Puerto Real, Cadiz, Spain. Mr. Rubio's improvements relate to furnace-grates or the arrangement and form of the fire-bars constituting the same, the object being to provide a form and arrangement of fire-bar adapted for use in boiler and like furnaces burning small coal or the residue obtained by washing coal, with the ultimate object of economy in fuel consumption. Although the bars are a less distance apart than usual with ordinary grates, the area for passage of air is greater.

CARBURETER.—A. J. O'SHEA, Fargo, N. D. In this contrivance the fluid-pressure in the supply-tank constantly tends to produce a flow through a partition-opening, and this will continue until the level rises to an upper opening, at which the vent-pipe will become closed and the flow will consequently stop. As the fluid in the carbureter evaporates or is taken up by the passing air the level will fall, freeing the upper opening, when the flow will resume until the original height has been restored.

Machines and Mechanical Devices.

ELEVATOR.—E. ALTMANN, Helena, Mont. In this instance the object is to provide an elevator more especially designed for elevating grain and the like and arranged to take up comparatively little room, to allow of conveying a large amount of material without requiring the running of the elevator at a high rate of speed, thus insuring long life to the elevator.

CONVERTIBLE LOCOMOTIVE AND STATIONARY ENGINE.—M. H. KELLY and E. E. PLOUGH, Spokane, Wash. In this patent the invention has reference to engines and to the mechanism used in connection therewith, and the more particular object of Messrs. Kelly and Plough being to produce a type of engine suitable for use as a locomotive or as a stationary engine, being readily convertible for this purpose.

Prime Movers and Their Accessories.

DEVICE FOR SEPARATING PISTON-RODS FROM CROSS-HEADS.—C. J. MCCARTHY, Moncton, New Brunswick, Canada. This invention relates to improvements in devices for removing or separating piston-rods from cross-heads; and the object is to provide a device of this character of simple construction, strong and durable, and that may be quickly attached to a cross-head and as readily detached therefrom.

STEAM-GENERATOR.—P. E. LEROUX, 7 Rue Sainte-Croix Arras, Pas de Calais, France. This generator comprises one or more series of horizontal water-drums connected in series or in parallel to a steam-collector and arranged above the fireplace, each series branched upon a vertical drum and preceded by one or more vertical water-drums in the flue. Upper part of each drum is connected to the next by means of a tube so that water arriving to the bottom of this tube is forced upward through the whole drum to pass into the next one. Horizontal drums branched upon the last vertical drum have means to circulate water in these parts and prevent swell. The same arrangement cools surface exposed to flames in drum next to fireplace.

Railways and Their Accessories.

CAR-COUPLING.—F. KELLER, Allentown, and D. BOWERS, Emaus, Pa. This coupling is simple, strong and durable, the parts well protected and not liable to be broken, and readily removable, the draw-head removable as a whole by withdrawal of its pin, while both the knuckle and locking-block may be separated in a similar manner, with the head in position. Coaction between the locking-block and locking-arm of the knuckle and the maintenance of the latter in position by its spring prevent accidental disengagement of the coupling by shocks or upon grades.

CAR-COUPLING.—C. A. MCKERAHAN, Wilmerding, Pa. This invention relates to couplings of the Janney type. The object is to provide details of construction which are readily cast into form at moderate cost, adapt the coupling for convenient and effective service, render it automatic in effecting engagement with another coupling of same character, facilitate detachment of two interlocked couplings, and conduce to safety by preventing the knuckle if broken from falling upon the track and possibly causing derailment of other cars.

DEVICE FOR HANGING AND OPERATING CAR-DOORS.—P. J. MCCULLOUGH, St. Louis, Mo. The purpose of this improvement is to provide a means controlled by a single lever for locking and unlocking the door and placing the door in and out of closing position and also to provide an auxiliary locking device capable of being used at will and which is independent of the lever, but serves to lock the lever against movement when the door is closed. The invention relates to an improvement in devices for hanging and operating car-doors, particularly flush doors for freight-cars.

GRAIN-DRIER FOR CARS.—J. J. SWAINE, Baltimore, Md. Mr. Swaine's invention is an improvement in driers especially designed for use in drying the grain in cars. The inventor is able to introduce air, heated or otherwise, to the body of grain at the bottom of the latter and throughout the area of the base of the grain, so the air circulating up through the mass of grain will thoroughly dry the same.

SWITCH-OPERATING DEVICE.—W. R. THURSTON, Jacksonville, Fla. In this patent the invention has reference to a device for operating switches which can be attached to an engine or a car of any kind and is intended to be so situated as to come into contact with a switch-operating mechanism located between the tracks and automatically open and close switches.

TRACK AND SWITCH SYSTEM.—W. R. THURSTON, Jacksonville, Fla. In the present instance the invention relates to a track and switch system constituting a safety device for use in connection with fast trains. The inventor's object is the provision of an automatic switching device which will be operated by the movement of a train to close all switches to side tracks and keep the main track open.

Pertaining to Vehicles.

HOLDBACK ATTACHMENT FOR VEHICLES.—J. T. MILLEN, Claxton, Ga. The object of this invention is to provide an improved attachment for vehicle-shafts which shall be adapted for convenient adjustment to accommodate horses of different sizes and lengths. The main feature of this improvement is the metal holdback-bar, which enables the usual holdback-straps and breeching of harness to be dispensed with and also greatly economizes time in hitching up and unhitching.

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Robert W. Hunt & Co. bureau of consultation, chemical and physical tests and inspection. The Rookery, Chicago.

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Inquiry No. 6354.—For makers of gasoline engines from 25 to 50 h. p.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company. Foot of East 138th Street, New York.

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I have every facility for manufacturing and marketing hardware and housefurnishing specialties. Wm. McDonald, 190 Main St., East Rochester, N. Y.

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Inquiry No. 6357.—For makers of or dealers in flexible wire screen.

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Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 6359.—For makers of or dealers in hay-baling machines.

Drawings, Estimates, Tools, Dies
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THE W. S. BURN MFG. CO., NEW HAVEN, CONN.

Inquiry No. 6360.—For manufacturers of hollow shafting.

Inquiry No. 6361.—For manufacturers of portable wood saws.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9512) P. G. W. says: I have a brazing torch that I bought some time ago, but do not seem to get heat enough to melt the brass so that it will flow. I use common brass wire. May be if I used spelter it would be better. What per cent gasoline should be used, and how should the articles be arranged when brazed? Is it necessary for the pieces to be brazed that they should be heated to a red heat? A. You should be able to braze with your torch if you use spelter, which you can make by adding 15 per cent of zinc to the brass that you are using. Also by placing the work on a piece of charcoal with a charcoal backing you should be able to braze with the brass wire. You must heat the piece to be brazed to a red heat.

(9513) O. K. says: A train a mile long is speeding at the rate of a mile a minute. A man is seated on the engine of the train, and another man on the rear car. The latter shoots at the man on the engine. Now, the question is, does the bullet hit the man up front? I forgot to add that the bullet is also traveling at the rate of a mile a minute. A. Your inquiry in reference to a gun fired on a moving train is constantly coming up. We have answered it six times in the SCIENTIFIC AMERICAN within two years. You will find it in queries 8823, 8862, 8997, 9058, 9270, 9433. Really the question is very simple. A gun will send a ball in exactly the same manner when the gun is in motion as when the gun is at rest. There is this difference: When the gun is at rest, the shot has but one motion; when the gun is in motion, the shot has two or more motions. In the case you propose, the shot moves with the motion of the train, and at the same time with the motion of the gun. With reference to the gun, it moves as if the train were at rest, and would hit a man at which it was aimed as if the train stood still. If you stood in a car and fired at a man at the opposite end of the car, you would expect to hit him while the train carried you and the shot along in another motion. If you could hit a man at the other end of a car, why ought not a man at the other end of a train be hit as well? The distances and velocities which you give have nothing to do with the question. They are but a relative matter. If a man could be hit with one velocity, he could be with another as well. Then, too, everybody on the earth is being carried in just the same way by the motion of the earth, and shots can be fired and objects hit as if the earth stood still. The whole matter is a very simple one to understand if the fact is seen and understood that the gun affects the shot as if the gun stood still, and the train carries the shot along also with all the motion which the train may have.

(9514) F. W. L. asks: The water furnished one town where I stop has such a percentage of air in it, that when it is drawn at the spigots it has the color of milk. It is clear, pure mountain water. After standing two or three minutes, it becomes perfectly clear. What causes this? The reservoir is about two miles from the town, and has a fall I believe of from three to five hundred feet. How could this be remedied? In metering this water, would there be more shown on the register than actually received? A. All natural water contains air. Under more pressure it can hold more air than when under ordinary pressure. So when the water of which you write flows from the pipe and escapes from pressure, the contained air expands and rises in bubbles. No harm is done by the air in the water. The air can be removed from the water by having a tank a little way above the town, into which the water may flow from the reservoir, and from which the service pipes will take it into the town. The small weight of air in the water cannot make any appreciable difference in the quantity of water passing a meter. Nor should we think it desirable to reduce the pressure in the mains for the sake of removing the air, since such a head as you name will produce a pressure sufficient for the best fire service.

NEW BOOKS, ETC.

FINANCIAL RED BOOK OF AMERICA. New York: The Financial Directory Association, 1904. Quarto; pp. 388.

This book contains nearly 15,000 names of wealthy Americans, whose fortunes have been the products of one hundred years of industrial activity. All persons estimated to be worth $300,000 or more are catalogued, the names being arranged alphabetically, and divided under States and their various cities and towns. With the full name of each person is given the business and residence address, and the principal business and financial connections of the individual. No specific estimates of wealth are given, however. The book will be found of use to those to whom a ready and reliable means of reference to wealthy persons is a business necessity.

ANTS AND SOME OTHER INSECTS. By Dr. August Forel, late Professor of Psychiatry at the University of Zurich. Translated from the German by Prof. William Morton Wheeler of the American Museum of Natural History, New York. Chicago: The Open Court Publishing Company, 1904. 8vo.; pp. 50. Price, 50 cents.

This book presents in an able manner an inquiry made by the author into the psychic powers of these small animals. It also contains an Appendix on the peculiarities of their olfactory sense. We heartily recommend it to naturalists, who will find considerable valuable information in its pages.

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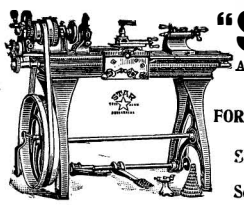

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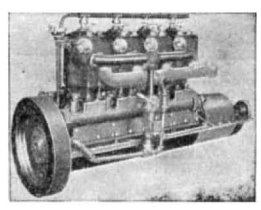

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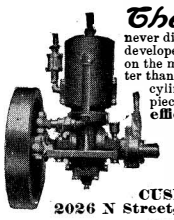

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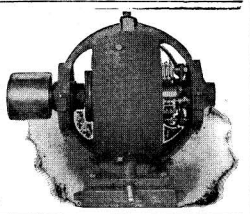

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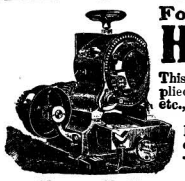

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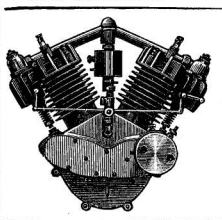

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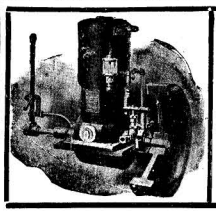

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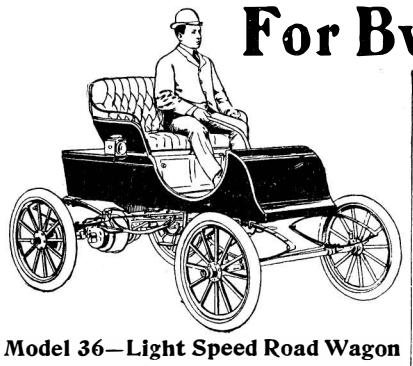

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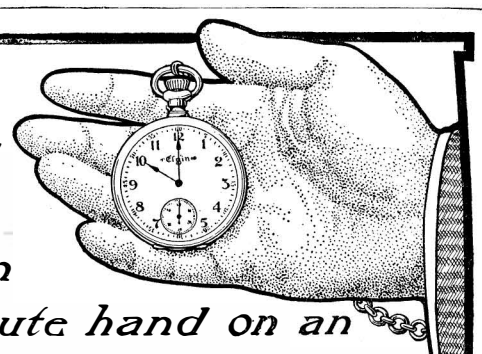

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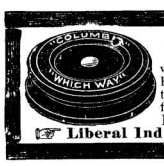

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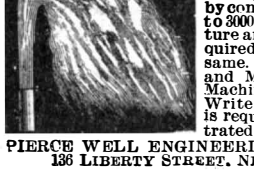

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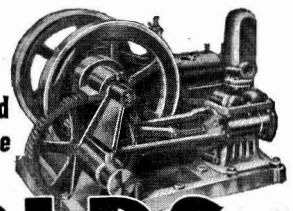

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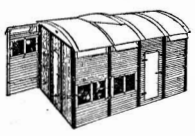

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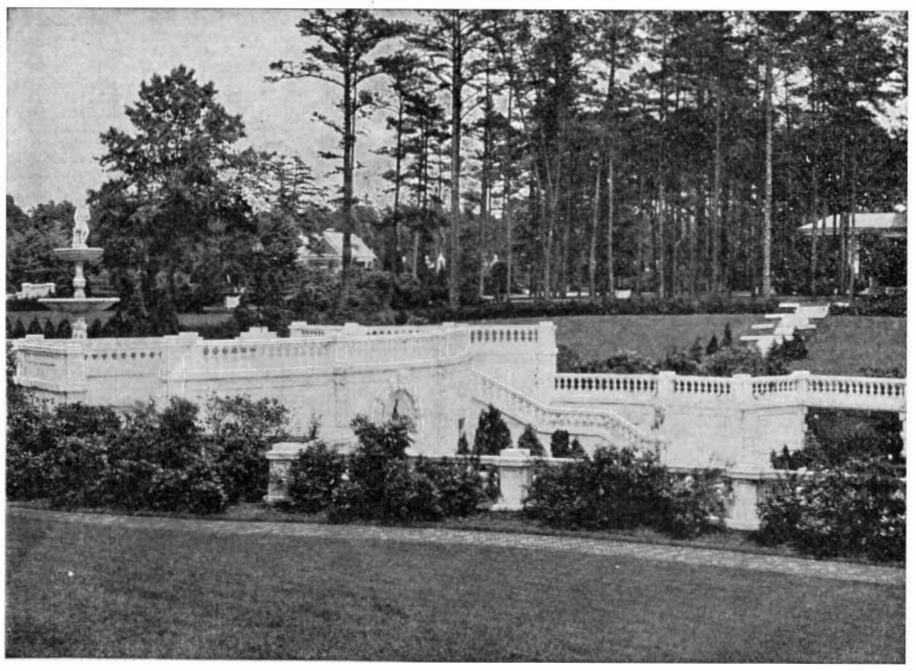

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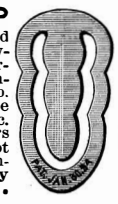

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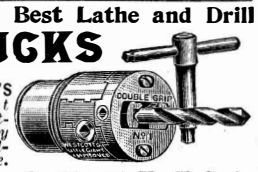

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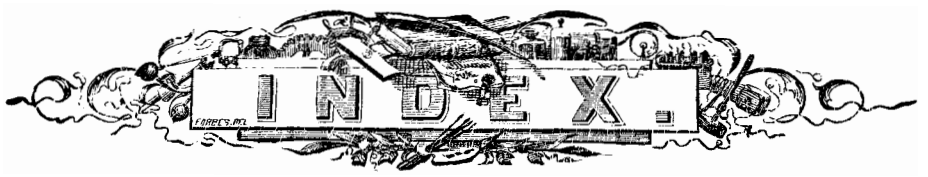

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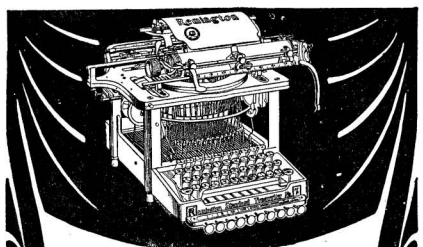

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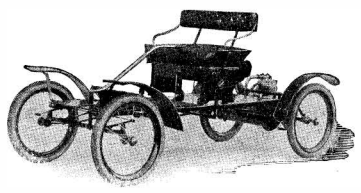

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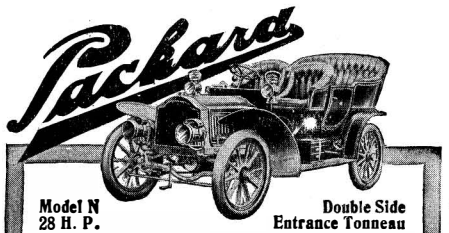

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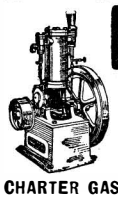

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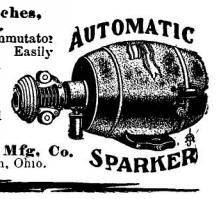

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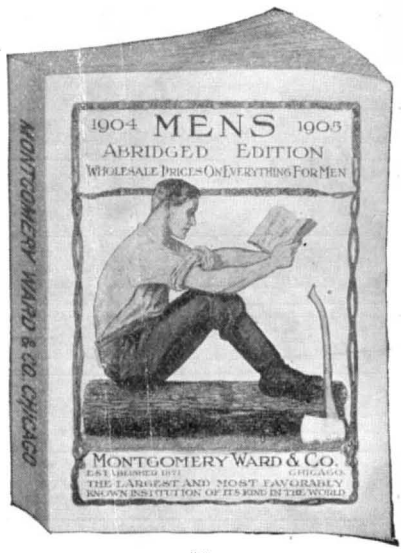
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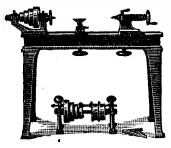

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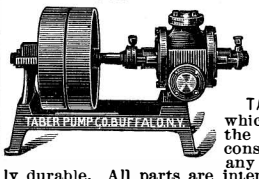

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